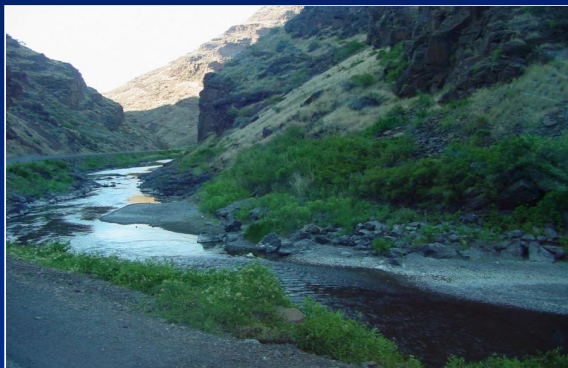
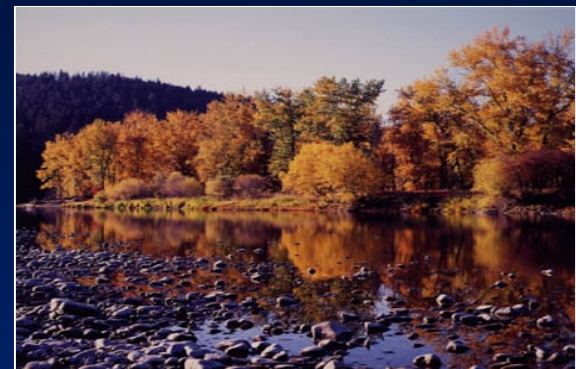
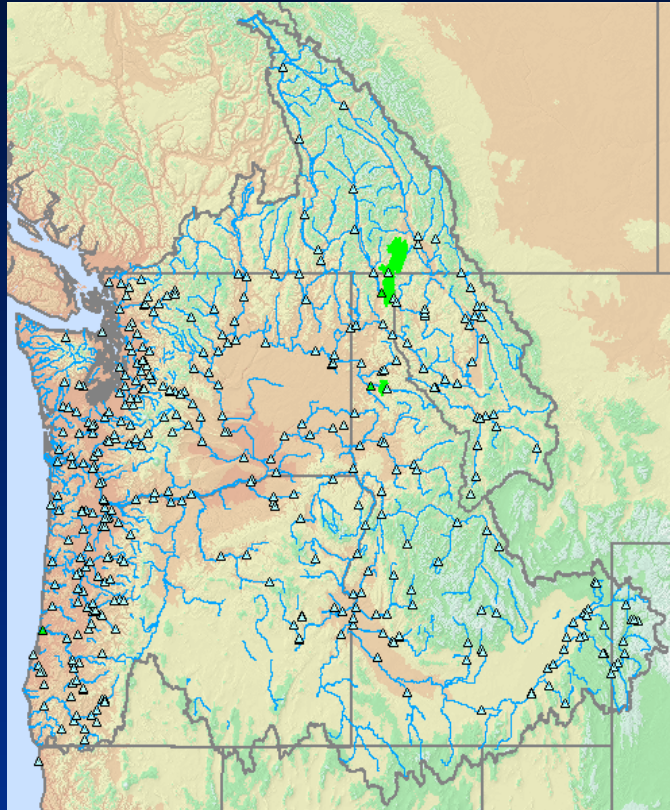


Northwest River Forecast Center

Regional River Forecasting





Afternoon Session



Introduction to the Northwest River Forecast Center

銅 Donald Laurine, Development & Operations
Hydrologist

Short-Range (1-10 Day) Forecast Services

銅 Kevin Berghoff, Senior Hydrologist

Long-Range (> 10 Day) Forecast Services

銅 Steve King, Hydrologist

Future Developments

銅 Rick van der Zweep, Hydrologist



Mission of NWRFC



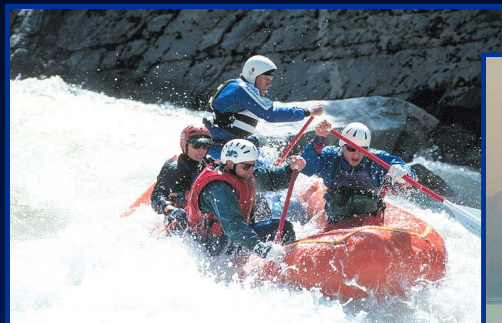
- **National Weather Service mission:**
Provide weather, hydrologic, and climate forecasts and warnings... for the protection of life and property...
...and the enhancement of the national economy.
- **The NWRFC accomplishes the NWS mission by:**
Providing unbiased hydrologic information to a wide variety of users including:
 - Short, Medium and Long Range River Forecasts
 - Water Supply Volume Forecasts
 - Unregulated Streamflow Estimates



NWRFC Forecast Usage



- Emergency Management
- Floods
- Drought
- Recreation
- Navigation
- Water Resource Management
- Hydropower Generation
- Fish and Wildlife Conservation
- Energy Marketing / Speculation



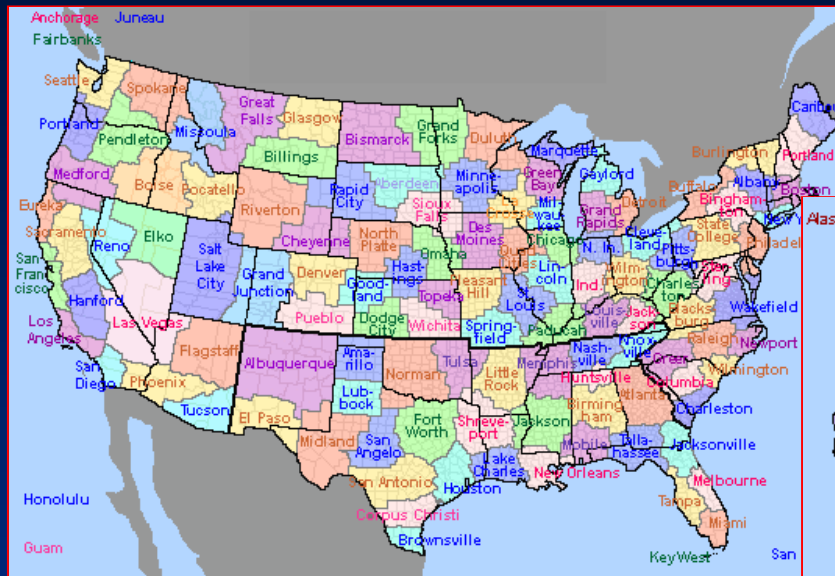


National Atmospheric and Oceanic Administration

National Weather Service



122 Weather Forecasts Offices (WFO's)

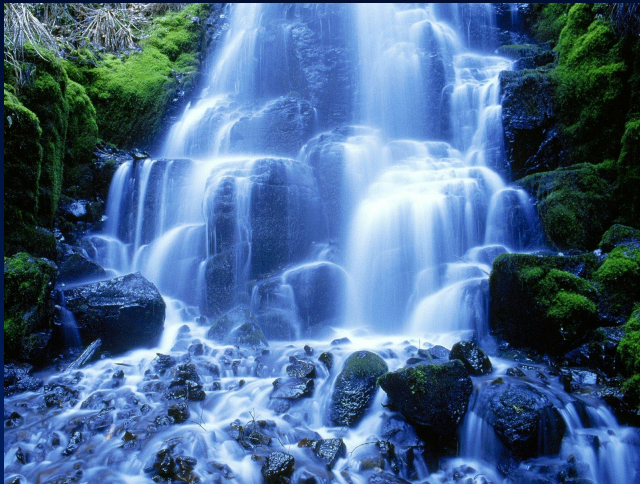


13 River Forecast Centers (RFC's)





Northwest River Forecast Center



- 314,000 sq mi Area
- Columbia Basin
- Coastal Drainages
of Oregon and Washington
- 6 States plus Canada
- 9 NWS Field Offices (WFO)





Northwest River Forecast Center

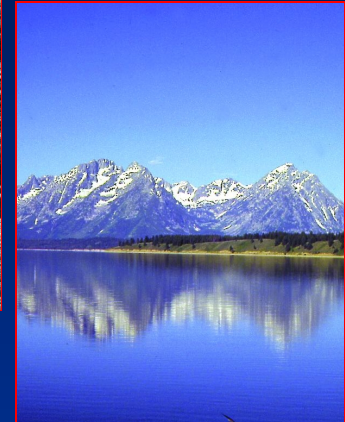
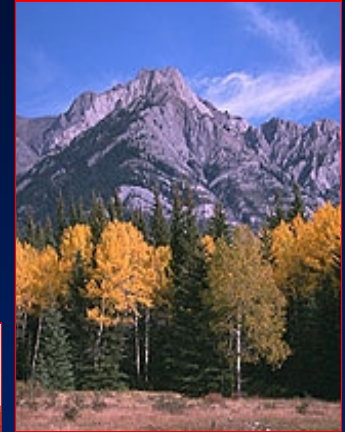


Staffing

- Hydrologists
- Meteorologists
- IT Support
- **new** Service Coordination Hydrologist

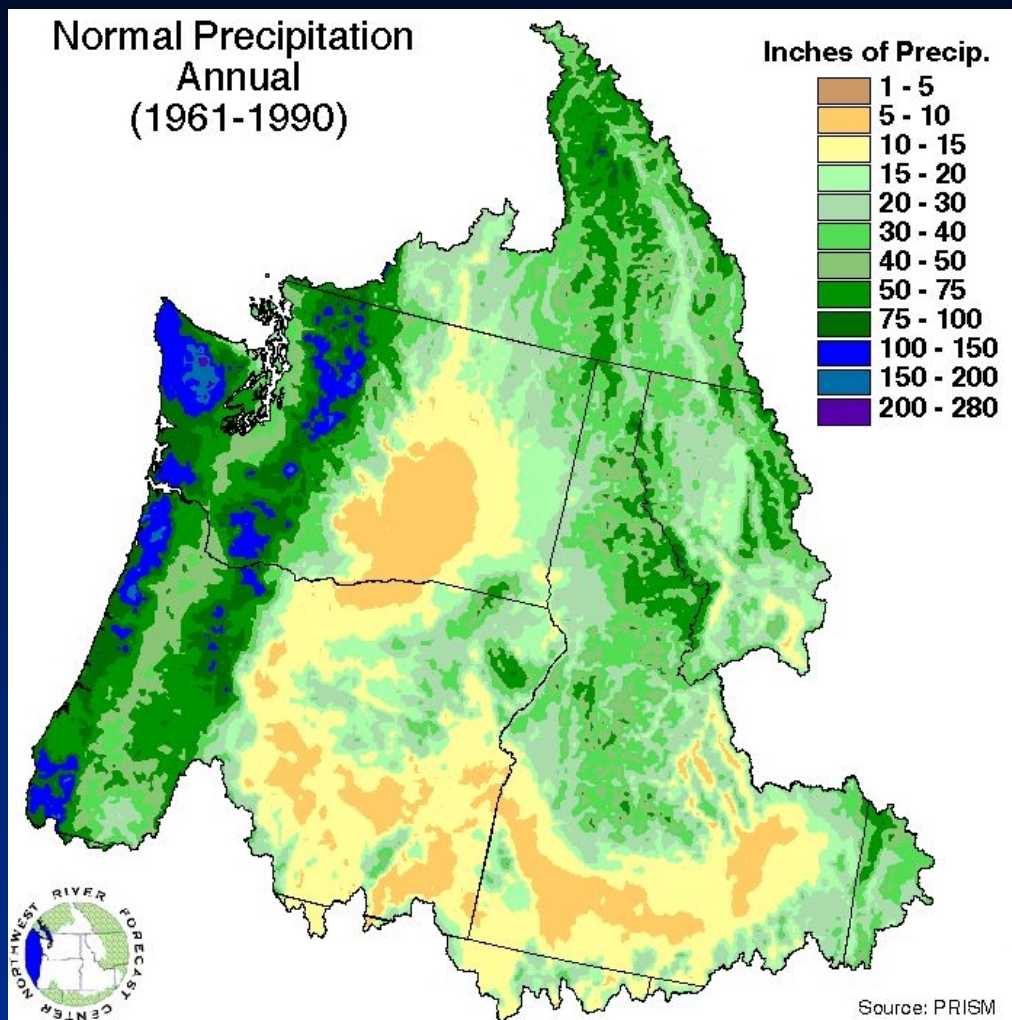


Hydrologic Influence: Geography



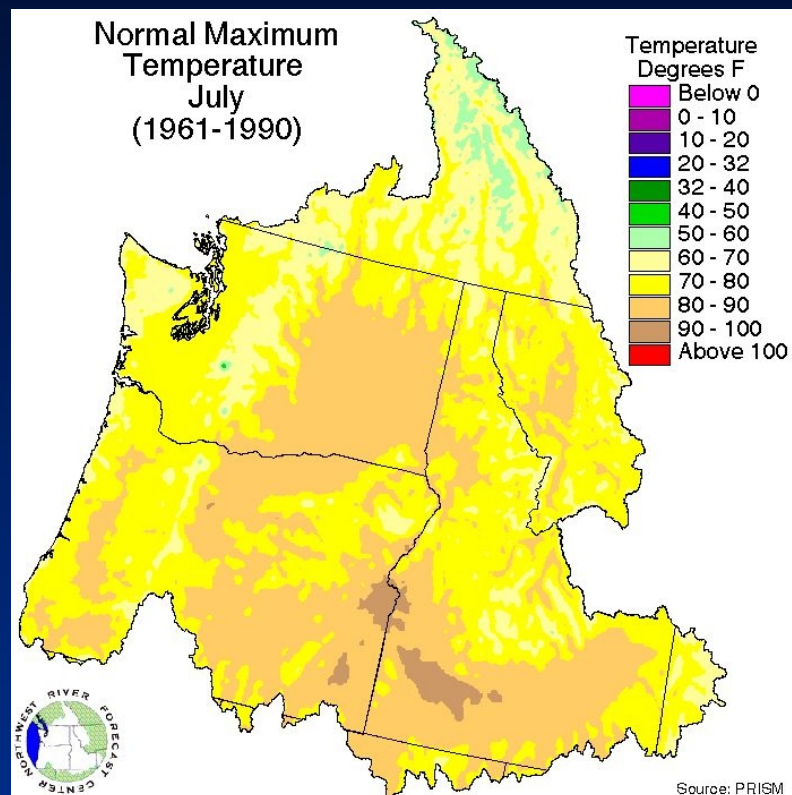
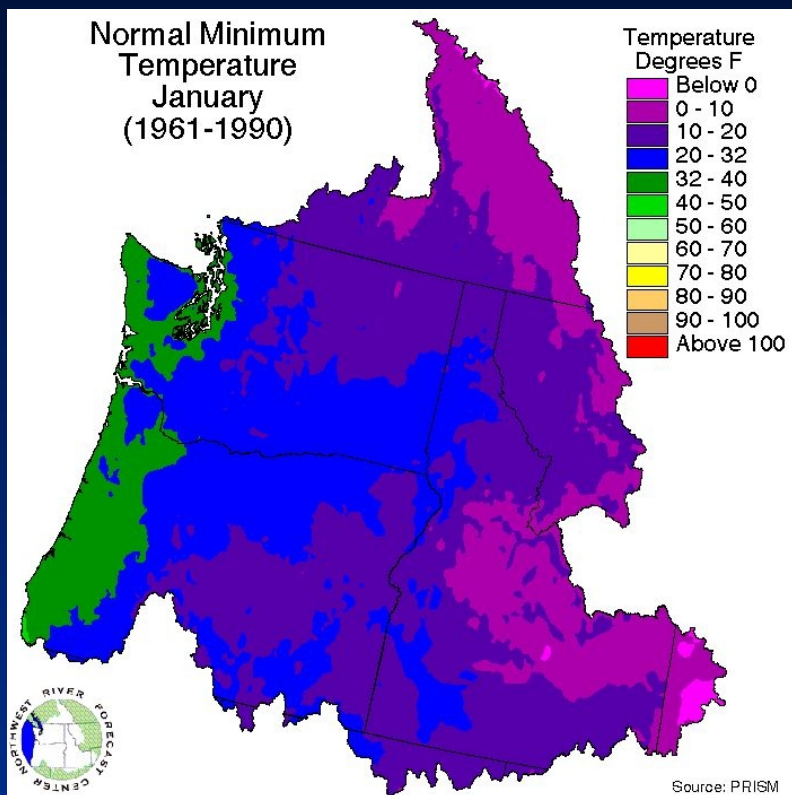


Hydrologic Influence: Precipitation





Hydrologic Influence: Temperature



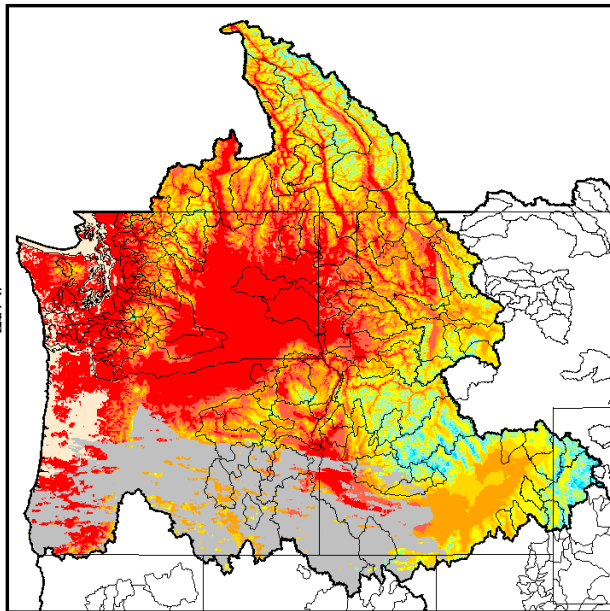


Hydrologic Influence: Snowmelt



53.2 N

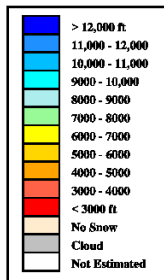
124.7 W



40.8 N

ELEVATIONAL AREAL EXTENT OF SNOW COVER 27-31 Jan 1996

Northwest River
Forecast Center



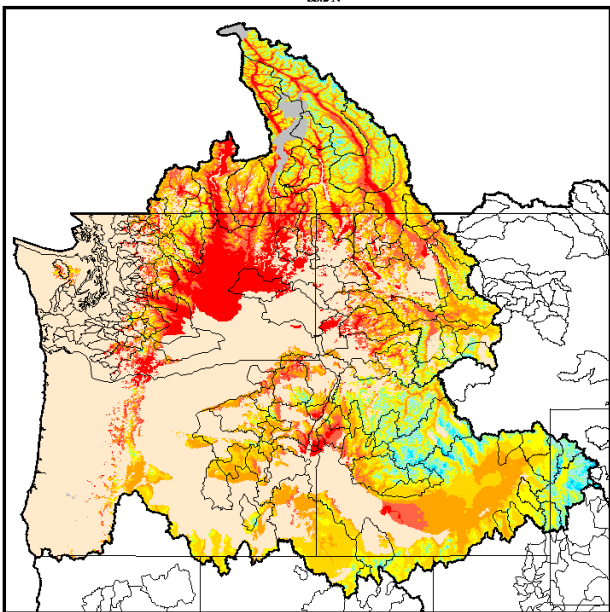
National Operational Hydrologic
Remote Sensing Center

Office of Hydrology
National Weather Service, NOAA
Chanhassen, Minnesota

nwr96031

53.2 N

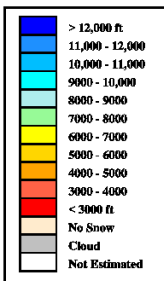
124.7 W



40.8 N

ELEVATIONAL AREAL EXTENT OF SNOW COVER 09-13 Feb 1996

Northwest River
Forecast Center



National Operational Hydrologic
Remote Sensing Center

Office of Hydrology
National Weather Service, NOAA
Chanhassen, Minnesota

nwr96044



96044213000
NOAA-14 AVHRR
False Color Composite
AV CH 1,3 & 4 as R G & B
NOHRSC / NWS / NOAA



Northwest Flood Examples:

Flash Flood: Heppner 1903





Northwest Flood Examples:

Snowmelt / Levee Failure: Vanport 1948





Historic Events:

Teton Dam Failure 1976





Northwest Flood Examples:

Rain/Snow: Willamette Valley, 1996





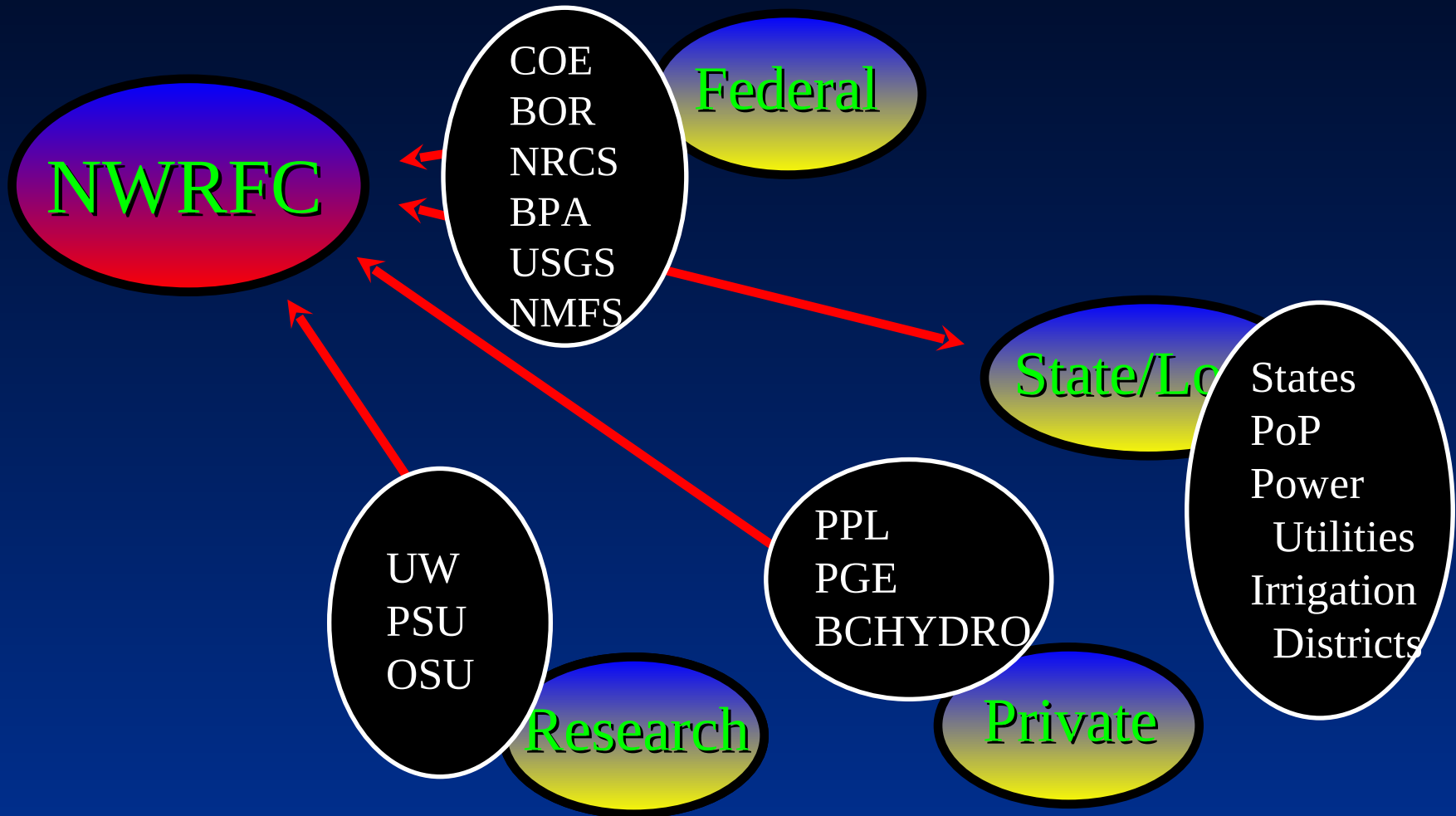
Northwest Flood Examples:

Rain: Chehalis, WA 2007



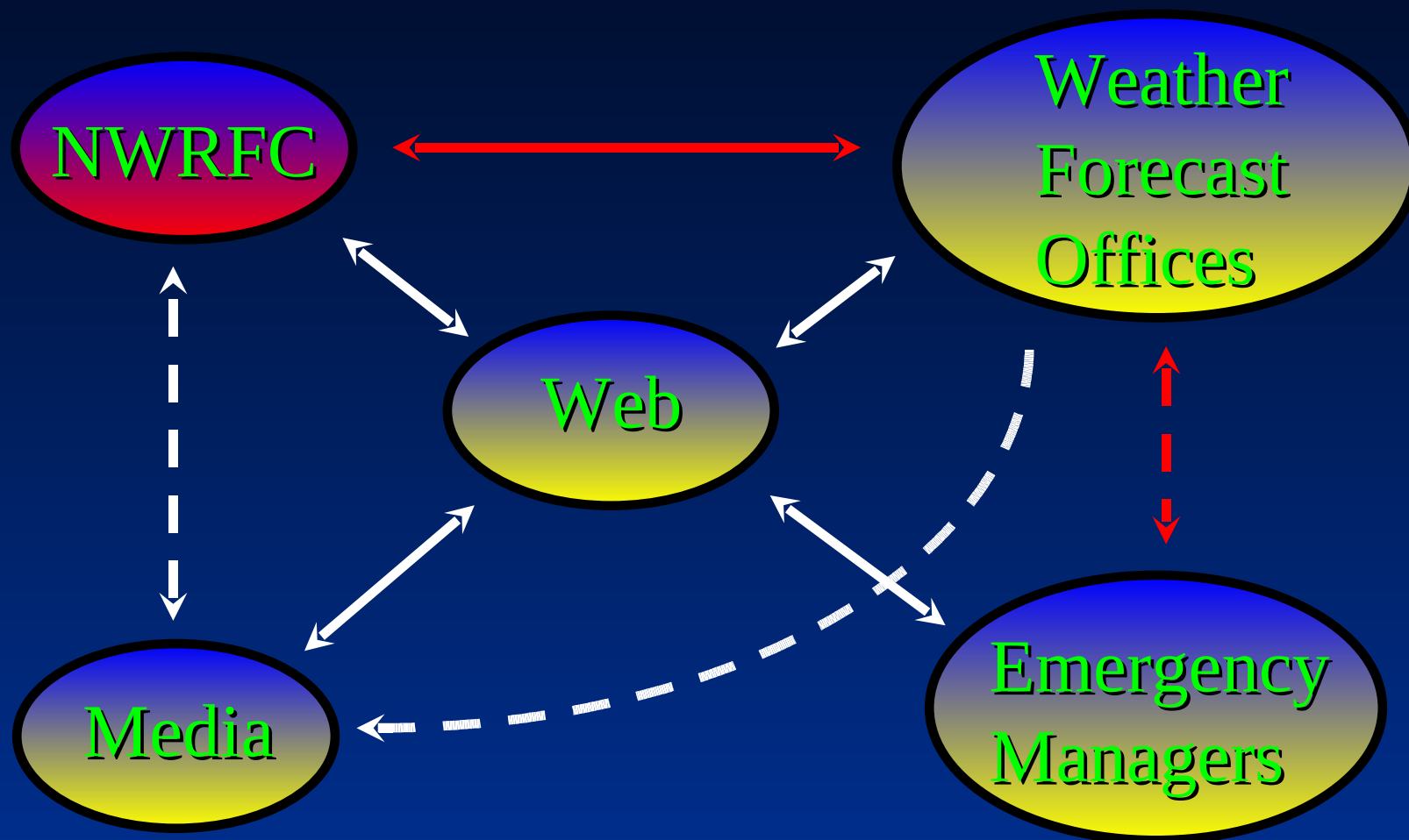


NWRFC Cooperators





Information Flow: Public

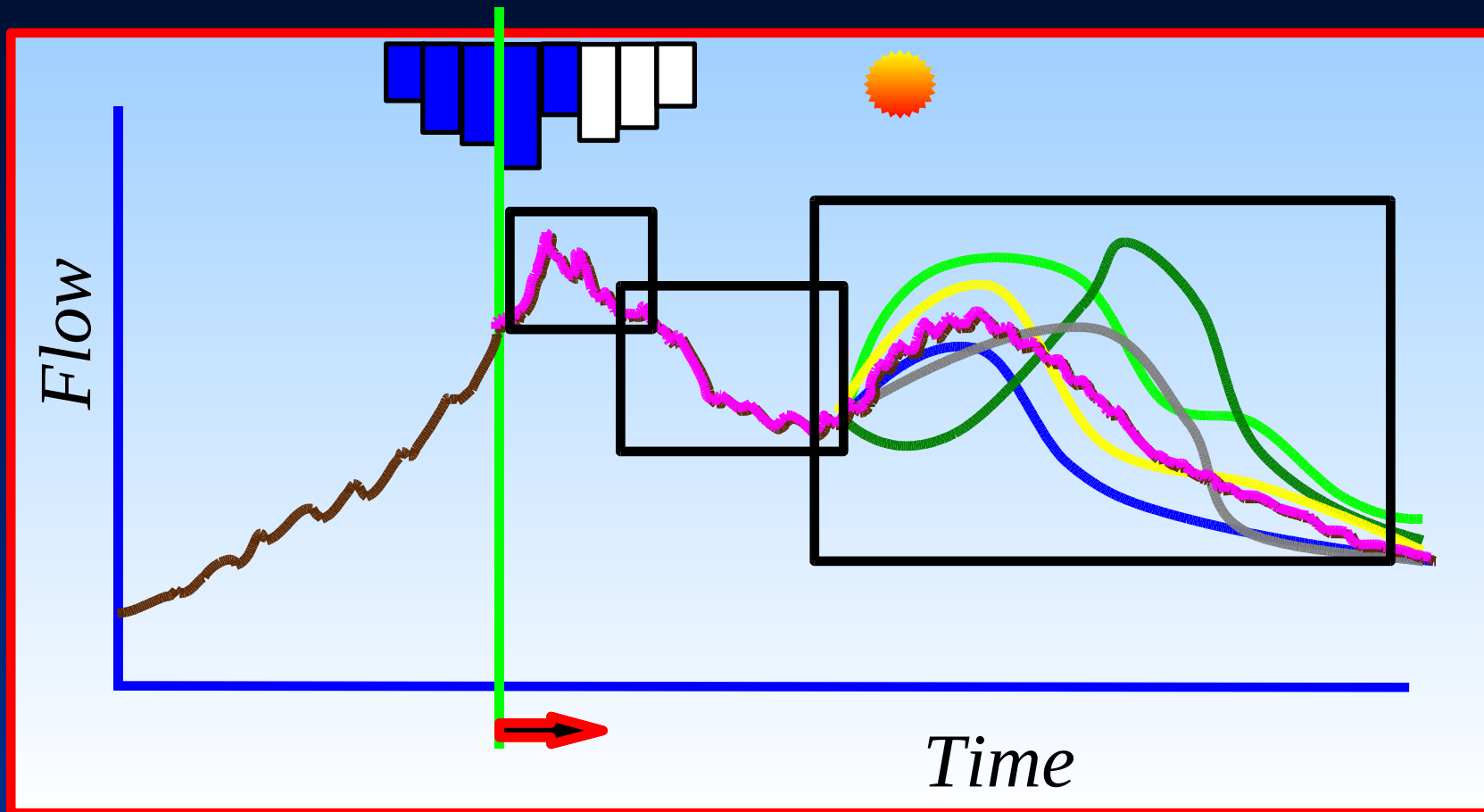




NWRFC Hours of Operation

- October through June
6:00 am - 6:00 pm, 7 days per week
- July through September
6am - 4:30pm, 7 days per week
- Evening and overnight coverage
as dictated by events

Hydrologic Forecasting: Time Domains



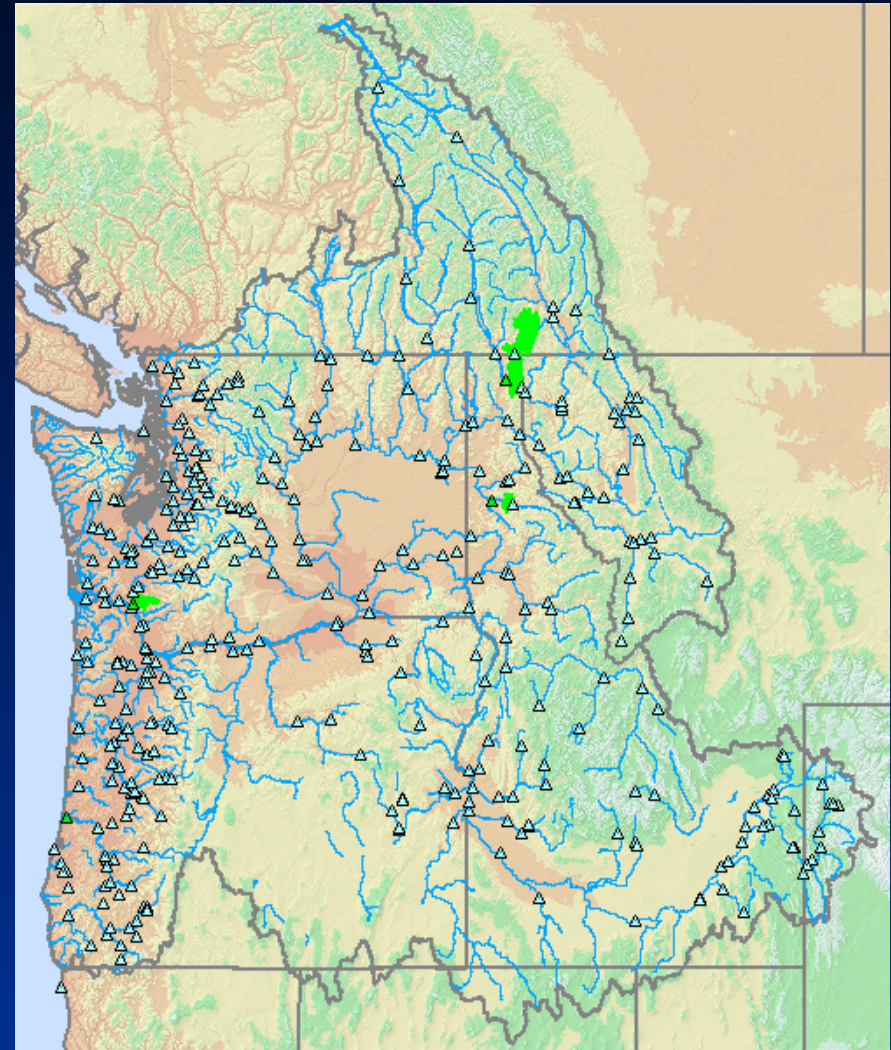


Northwest River Forecast Center

Short Range River Forecast Products



- 10 Day Deterministic Forecast
- Columbia and Snake River Basins
- Washington and Oregon Coastal Rivers
- National Weather Service River Forecast System (NWSRFS) Model
 - 鋪 Flood, Navigation, Water Management, Recreation
 - 鋪 Model Inputs, Products





Flood Forecast



Chehalis 2007



Source: Seattle Times

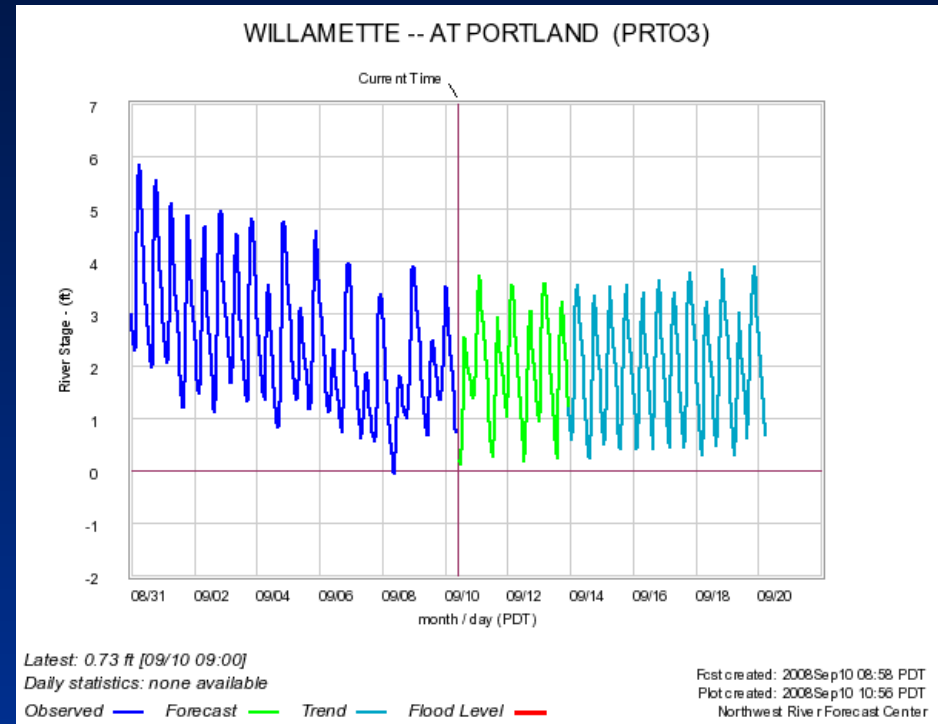
Chehalis 2007



Vanport 1948

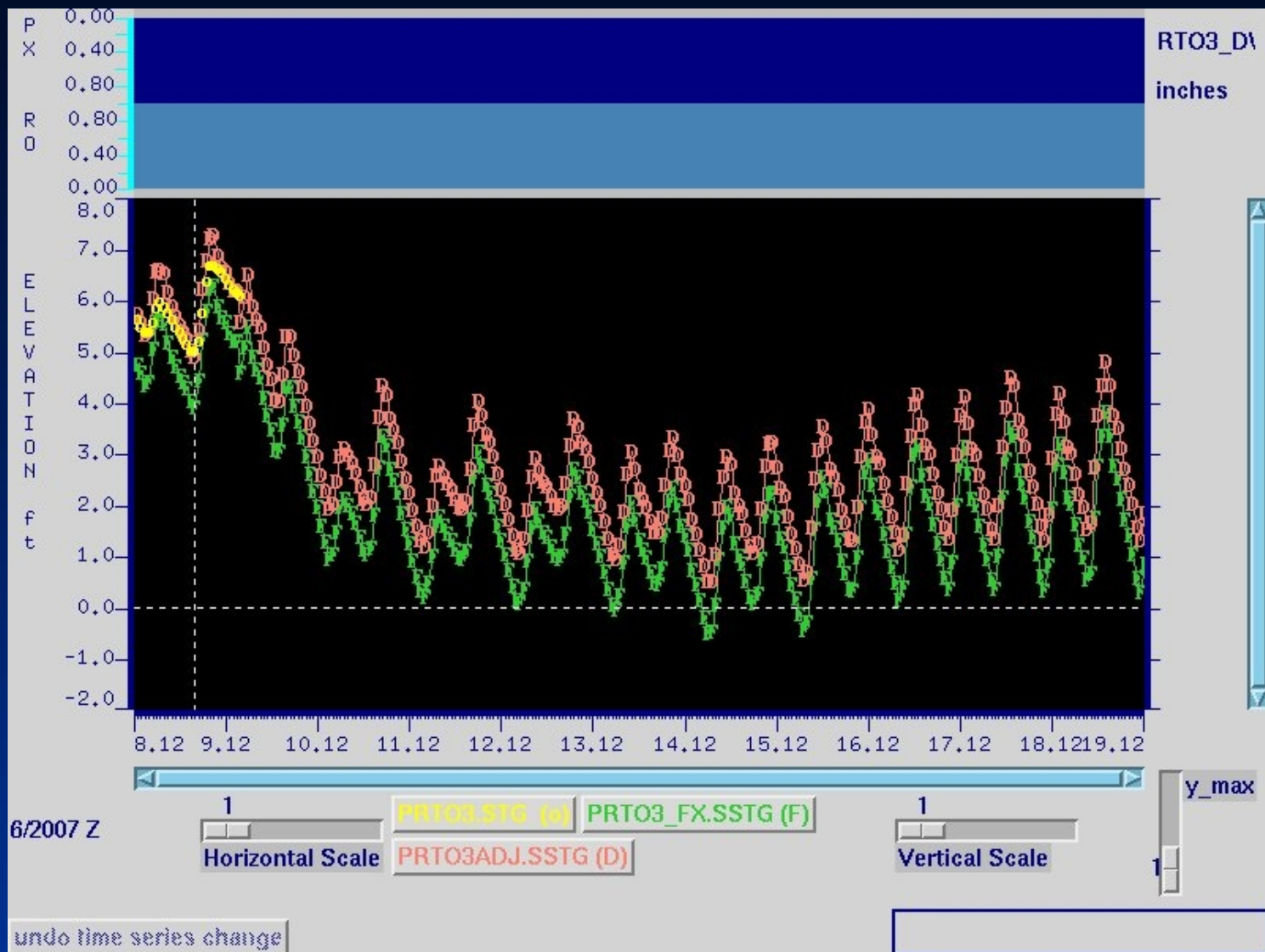


Navigation Forecasts





Low Flow Forecast

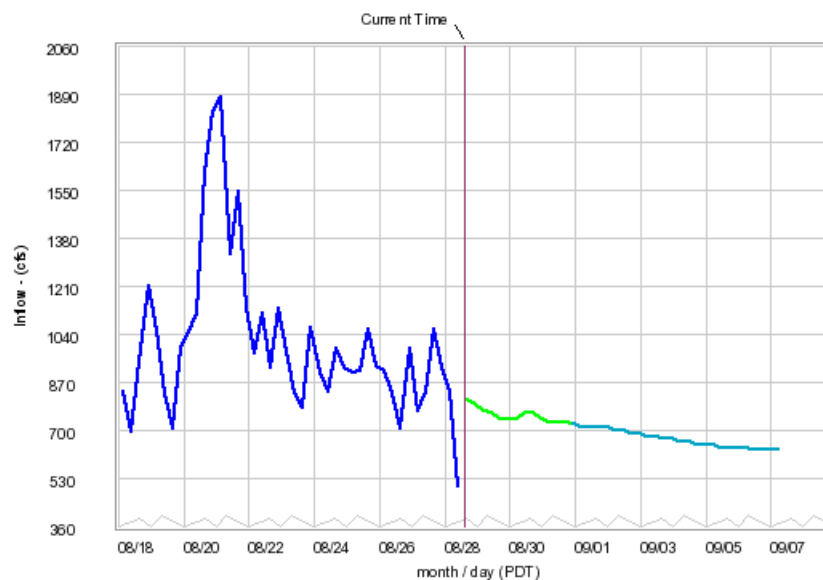




Water Management



NF SANTIAM -- DETROIT DAM (DETO3)



Latest: 502 cfs [08/28 10:00]

Daily statistics: none available

Observed — Forecast — Trend —

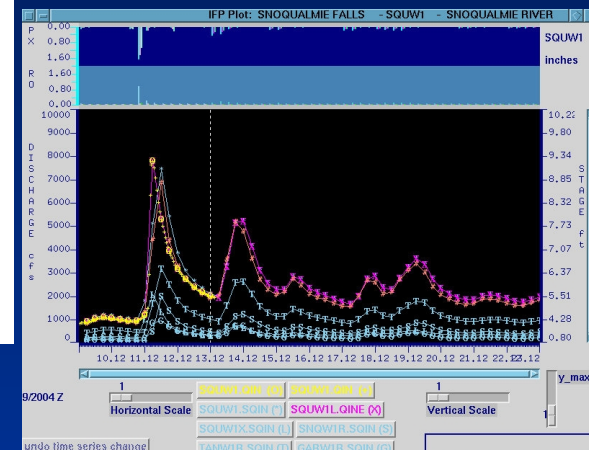
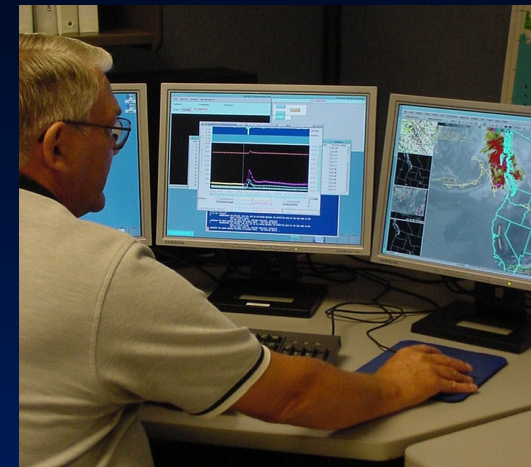
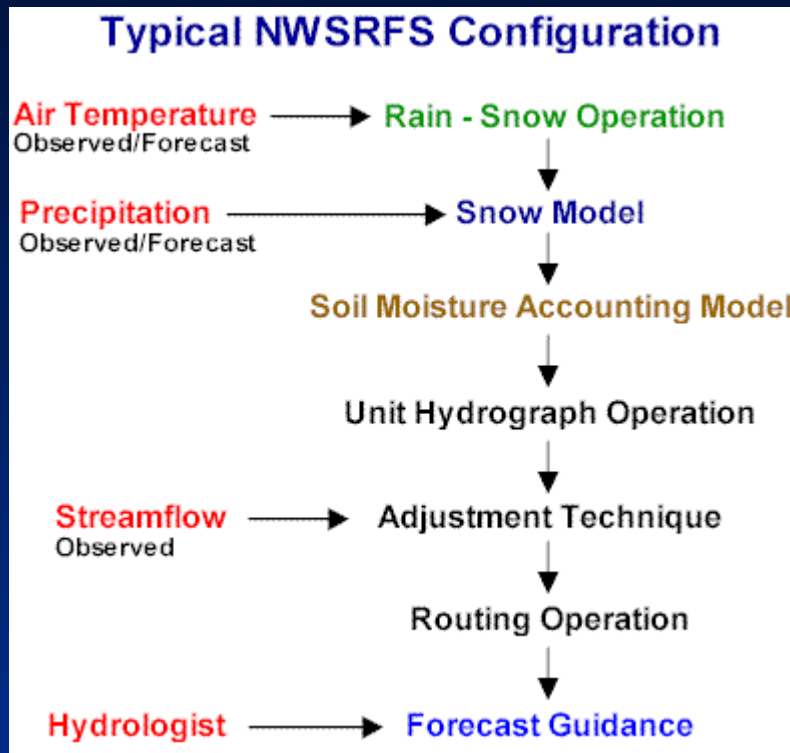
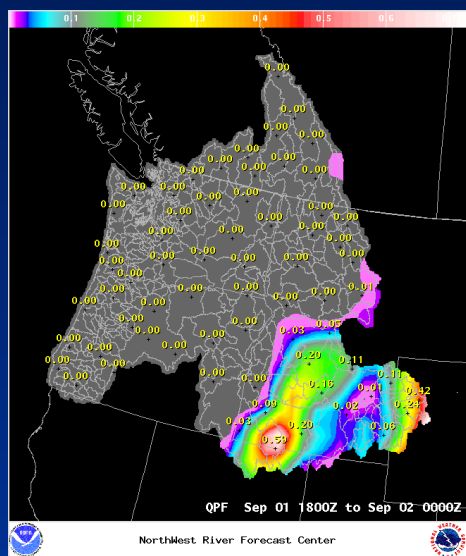
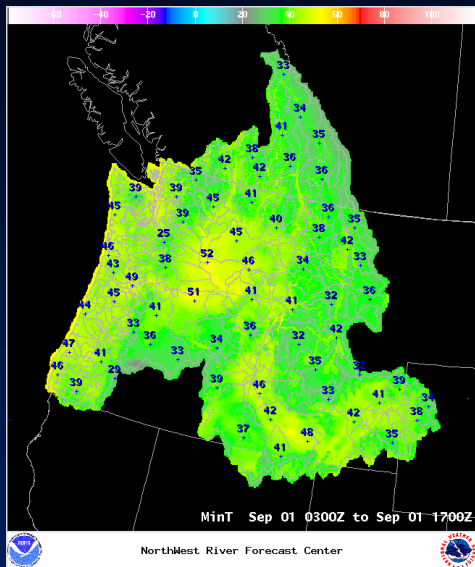
Plot created: 2008 Aug 28 10:24 PDT

Plot created: 2008 Aug 28 14:22 PDT

Northwest River Forecast Center

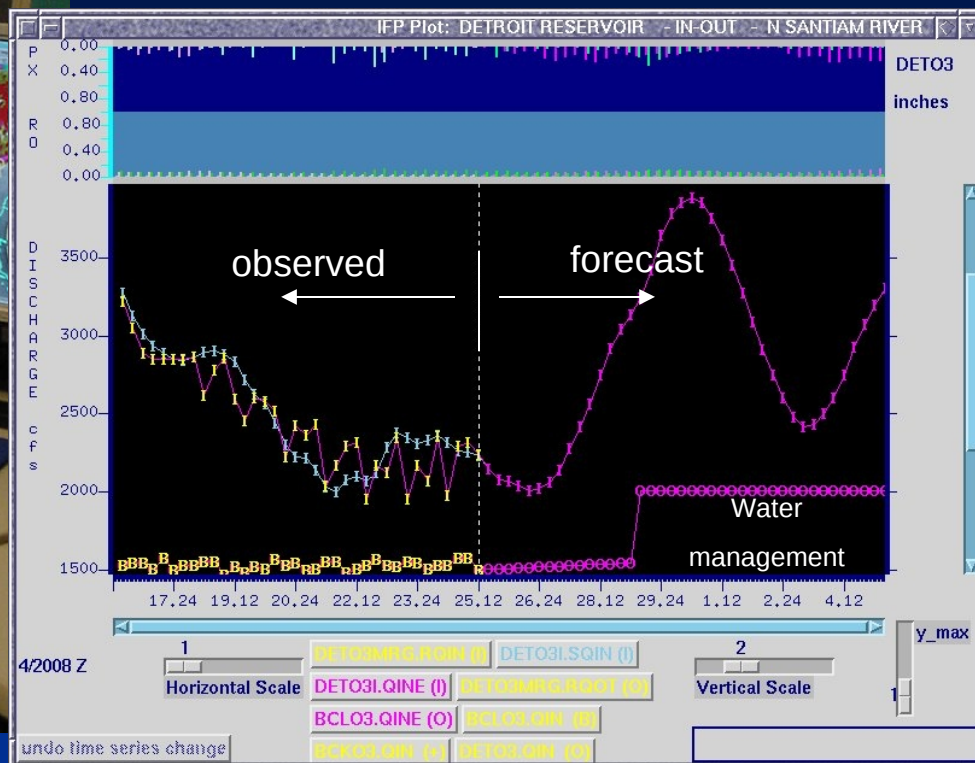
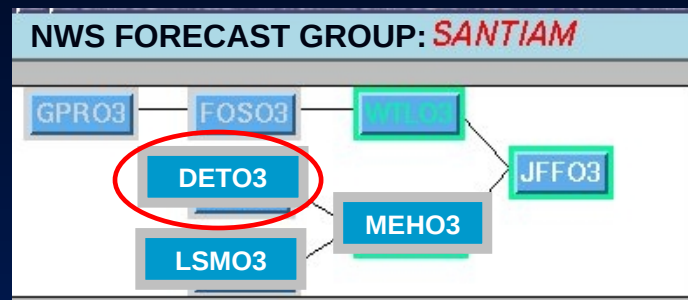
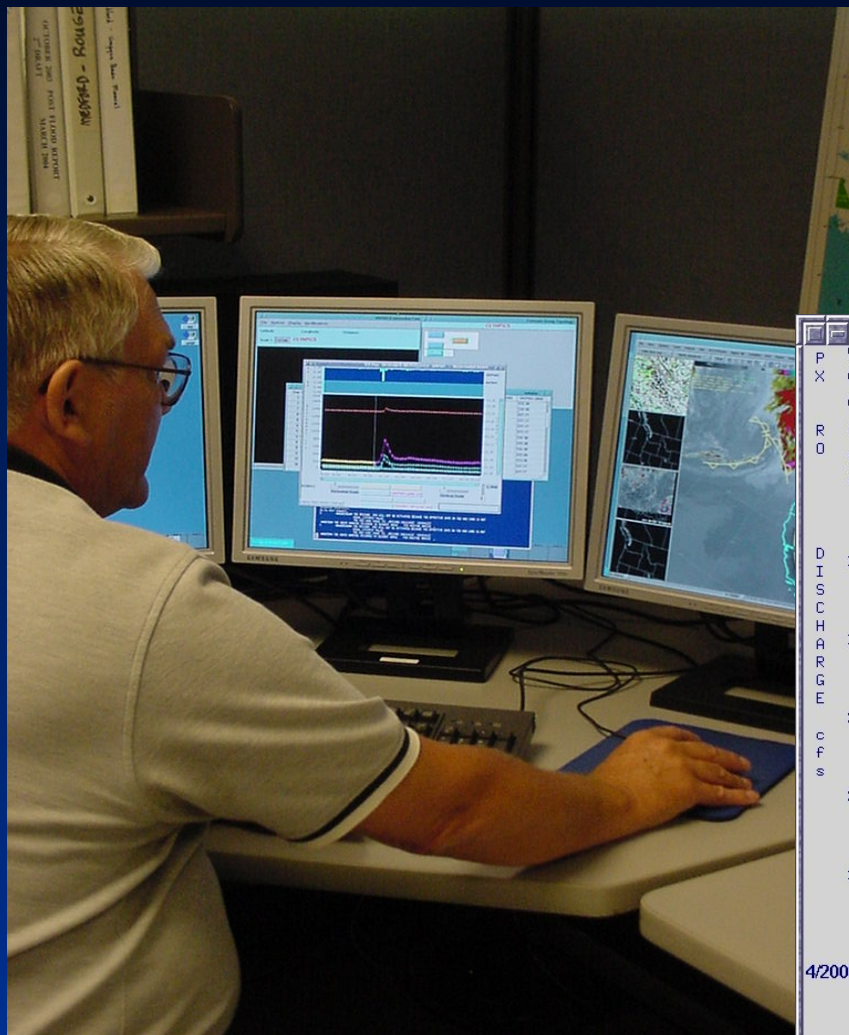


NWS River Forecast System (NWSRFS)





NWS Operations Overview: Interactive Forecast Procedure





NWS River Forecast Products



CHEHALIS -- AT CENTRALIA (CENW1)

Flood Stage: 65.00 ft

Observed		Forecast / Trend	
Date	Time River Stage (ft)	Date	Time River Stage (ft)
09/10/2008	1100 48.75	09/10/2008	1700 48.74
09/10/2008	0900 48.75	09/10/2008	2300 48.73
09/10/2008	0830 48.76	09/11/2008	1700 48.73
09/10/2008	0000 48.76	09/11/2008	2300 48.72
09/09/2008	2330 48.77	09/15/2008	1700 48.72
09/09/2008	1830 48.77	09/15/2008	2300 48.71
09/09/2008	1800 48.78	09/20/2008	0500 48.71
09/09/2008	0500 48.78		
09/09/2008	0430 48.77		
09/09/2008	0300 48.77		
09/09/2008	0230 48.76		
09/08/2008	1900 48.76		
09/08/2008	1830 48.77		
09/08/2008	1730 48.77		
09/08/2008	1700 48.78		
09/08/2008	1130 48.78		
09/08/2008	1100 48.79		
09/08/2008	0400 48.79		
09/08/2008	0330 48.80		
09/07/2008	0730 48.80		
09/07/2008	0700 48.81		
09/06/2008	2330 48.81		
09/06/2008	2300 48.82		
09/06/2008	2200 48.82		
09/06/2008	2130 48.81		
09/06/2008	2030 48.81		
09/06/2008	2000 48.82		
09/06/2008	1730 48.82		
09/06/2008	1700 48.81		
09/06/2008	1030 48.81		
09/06/2008	1000 48.82		
09/06/2008	0630 48.82		
09/06/2008	0600 48.83		
09/06/2008	0430 48.83		
09/06/2008	0400 48.84		
09/05/2008	1730 48.84		
09/05/2008	1700 48.85		
09/05/2008	1500 48.85		
09/05/2008	1430 48.86		
09/05/2008	1030 48.86		
09/05/2008	1000 48.87		
09/05/2008	0600 48.87		
09/05/2008	0530 48.86		
09/05/2008	0300 48.86		
09/05/2008	0230 48.85		

CHEHALIS--AT CENTRALIA (CENW1)

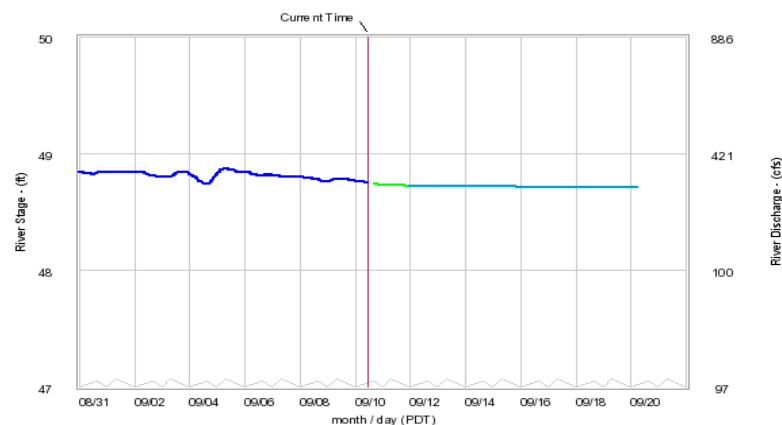
County: LEWIS State: WA
Elevation: 185 (feet) Latitude: 46 42' 42" Longitude: 122 58' 39"
Flood Stage: 65.00 (feet) Bankfull Stage: 61.00 (feet)

River Information Plots

Wednesday - September 10, 11:29 PDT

The following data are preliminary and is subject to change

CHEHALIS -- AT CENTRALIA (CENW1)



Latest: 48.75 ft 285 cfs (1% of flood flow) [09/10 11:00]

Daily statistics: none available

Plot created: 2008 Sep 10 09:00 PDT
Plot created: 2008 Sep 10 11:29 PDT
Northwest River Forecast Center

For Data Used In Plot [XML](#)

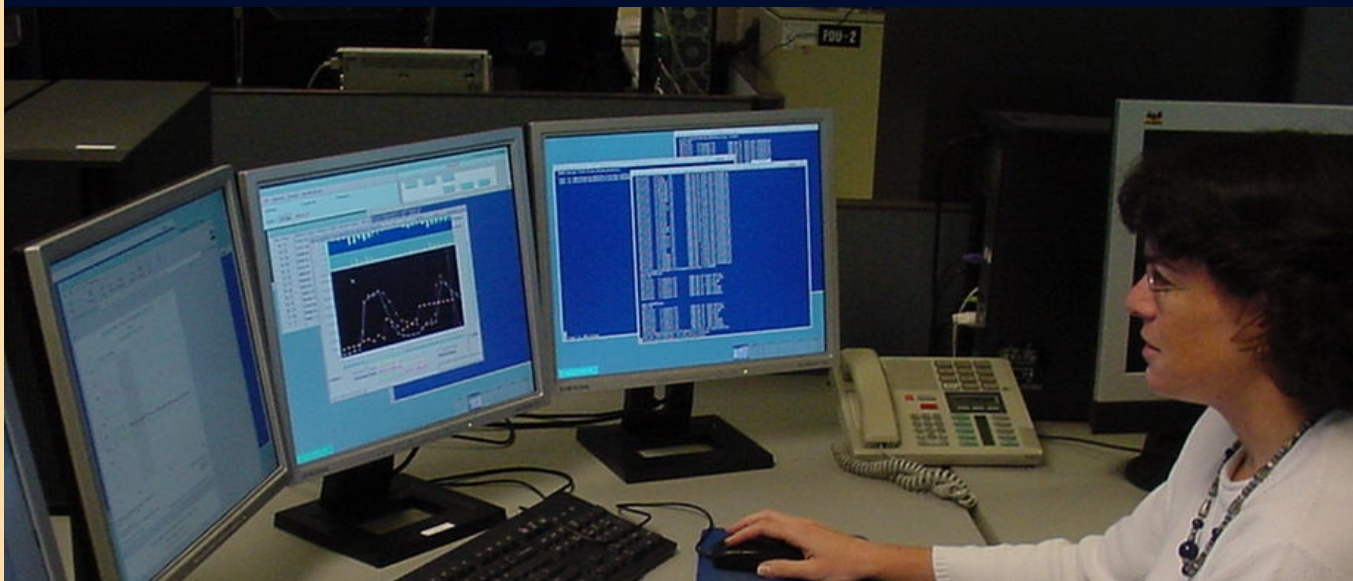
Show Flood Stage | Scale to Zero Stage | Hide Statistics | Plot Max Number Days | Plot Water Year



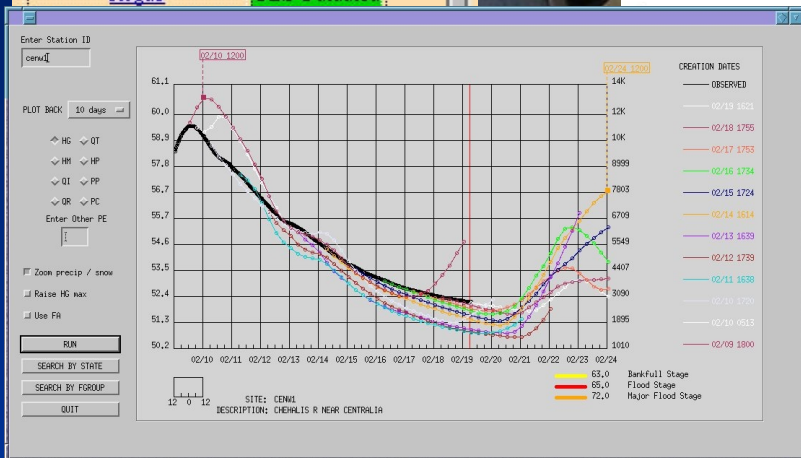
Forecast Review and Updating



River Forecast Group	Status
Nooksack	OK
Skagit	OBS Outdated
Stillaguamish	OK
Snohomish	OK
Middle Sound	OBS Outdated
South Sound	OBS Outdated
Olympic	OK
Chehalis	OK
Cowlitz River	Update
Lewis	OBS Outdated
Harbor - Lower Columbia	Update
Oregon Coastal	OK
Willamette Urban	OK
Willamette Headwater	OBS Outdated
Willamette South	OBS Outdated
Santiam	OK
Willamette Mainstem	Update
Umpqua	OK
Coquille	OK
Rogue	OBS Outdated



Northwest River Forecast Center
Streamflow Monitoring System



Chehalis Forecast Group														Last Updated: 2008-02-19 19:47:15			
FS	WS	FCST	OBS	OBS Time GMT	1 HR Chg	6 HR Chg	24 HR Chg	OBS Mag	FCST Mag	HW WS	HW FS	GT % Dif	GT Dif	ABV WS	ABV FS		
			4.3	16:15	0.00	0.00	-0.01										
			6.78	16:15	0.00	-0.02	-0.05										
13.5	12.0	7.10	7.12	16:15	0.00	-0.01	-0.08										
85.0	83.0	76.07	76.1	17:00	0.00	-0.02	-0.16										
		3.58	3.6	19:00	0.00	-0.03	-0.11										
		3.88	3.92	19:30	-0.02	-0.02	-0.03										
			192.82	17:00	0.00	-0.01	-0.08										
65.0	63.0	52.16	52.2	18:30	0.00	-0.03	-0.19										
14.0	11.0	6.23	6.24	16:00	0.00	-0.03	-0.16										
21.0	19.0	10.06	10.06	19:00	-0.02	-0.10	-0.46										
34.0	32.0	26.64	26.69	19:00	0.00	-0.01	-0.09										
			235.00	15:00	13.12	-15.62	0.00										
			766.21	18:45	0.00	-0.01	-0.03										
		310.00	304.4	15:30	-4.20	0.00	0.00										
19.0	15.5	4.41	4.43	19:00	0.00	-0.01	-0.09										



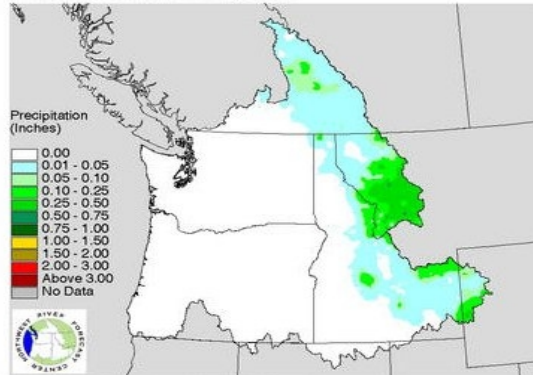
Accessing Observed Data Input

www.nwrfc.noaa.gov/weather/10_day.cgi



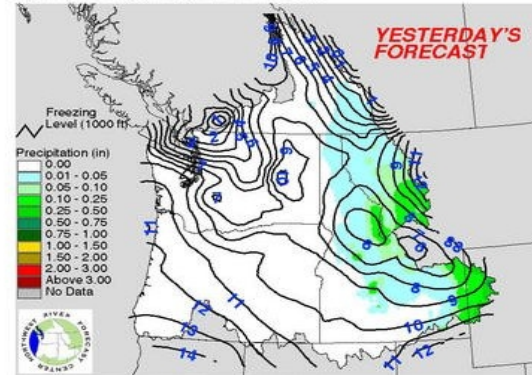
Yesterday's Precipitation Observed, Forecasted, and Deviation from Forecast

Yesterday's Observed Precipitation



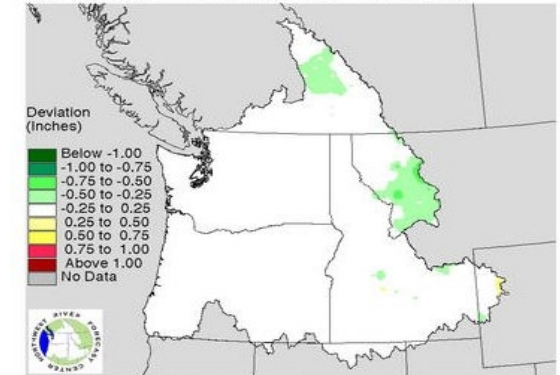
Creation Time: Tue, Sep 02 2008 08:11:38

Day 1 (Monday) Precipitation Forecast



Creation Time: Mon, Sep 01 2008 12:28:11

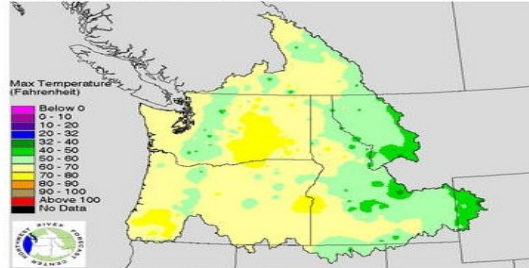
Day 1 Precipitation Deviation (Forecast - Observation)



Creation Time: Tue, Sep 02 2008 08:15:54

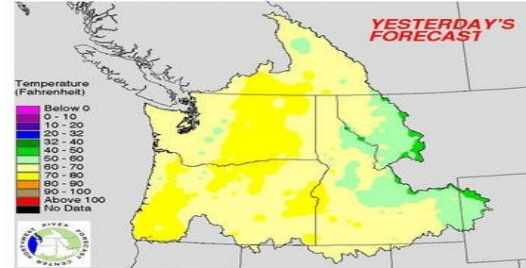
Yesterday's Max Temperature Observed, Forecasted, and Deviation from Forecast

Yesterday's Maximum Temperatures



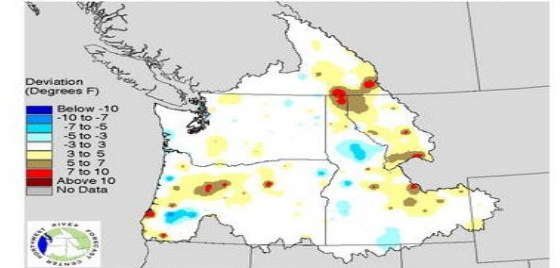
Creation Time: Tue, Sep 02 2008 08:12:10

Day 1 (Monday) Max Temperature Forecast



Creation Time: Mon, Sep 01 2008 12:20:20

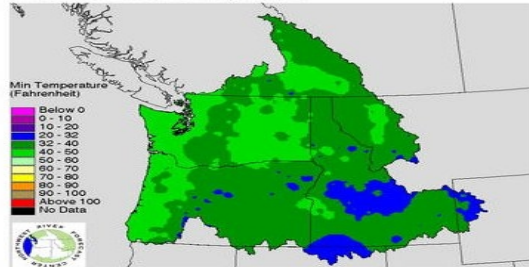
Day 1 Max Temperature Deviation (Forecast - Observation)



Creation Time: Tue, Sep 02 2008 08:16:27

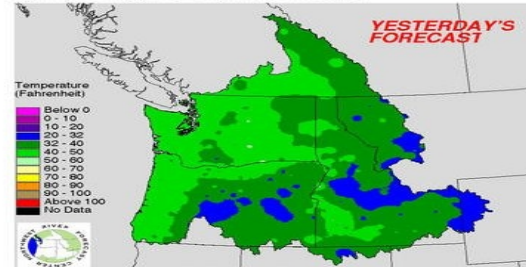
Yesterday's Min Temperature Observed, Forecasted, and Deviation from Forecast

Yesterday's Minimum Temperatures



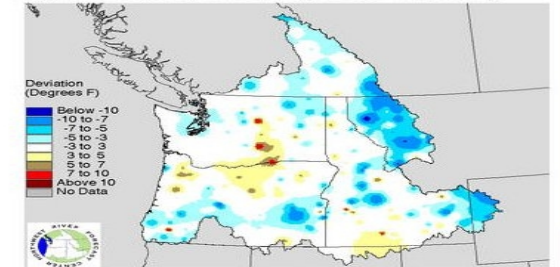
Creation Time: Tue, Sep 02 2008 08:12:42

Day 1 (Monday) Min Temperature Forecast



Creation Time: Mon, Sep 01 2008 12:20:43

Day 1 Min Temperature Deviation (Forecast - Observation)



Creation Time: Tue, Sep 02 2008 08:17:01



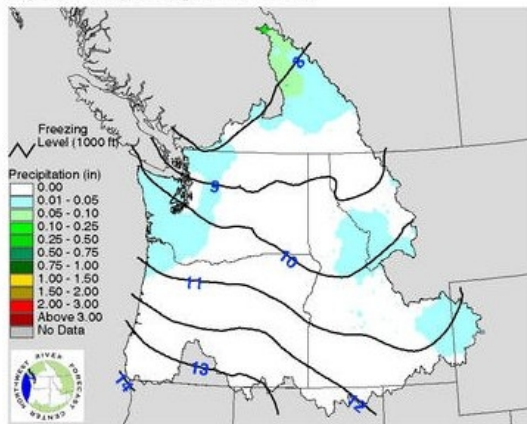
Accessing Forecast Data Input

www.nwrfc.noaa.gov/weather/10_day.cgi

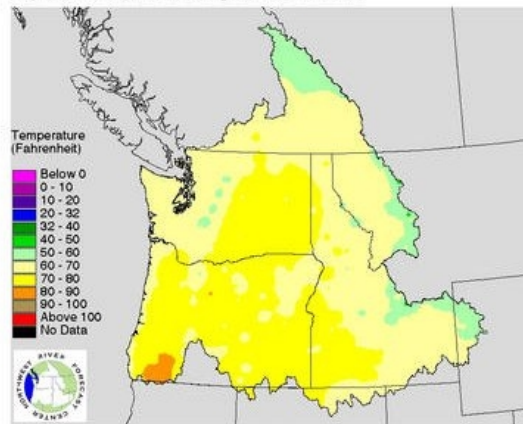


Day 1 Forecast

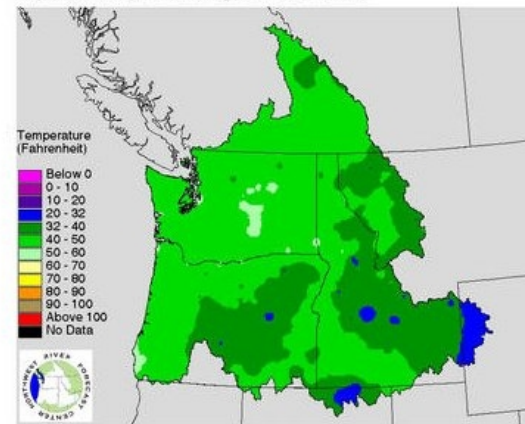
Day 1 (Tuesday) Precipitation Forecast



Day 1 (Tuesday) Max Temperature Forecast

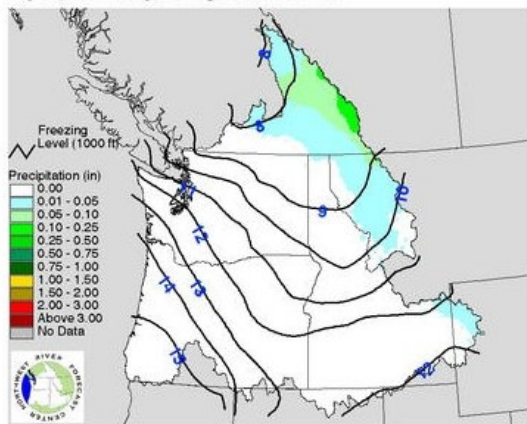


Day 1 (Tuesday) Min Temperature Forecast

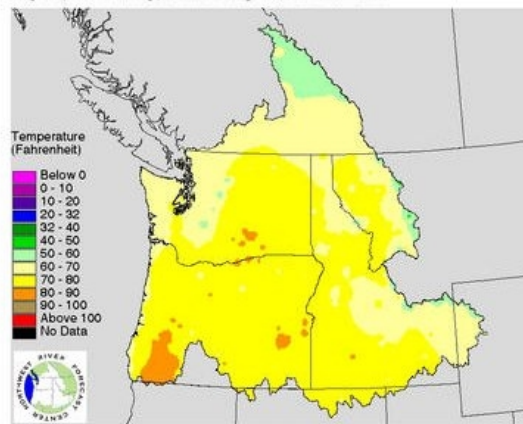


Day 2 Forecast

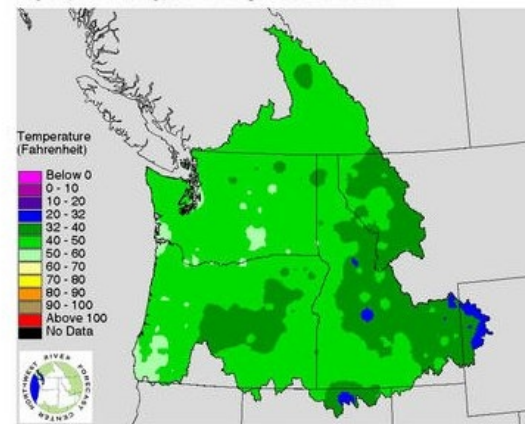
Day 2 (Wednesday) Precipitation Forecast



Day 2 (Wednesday) Max Temperature Forecast



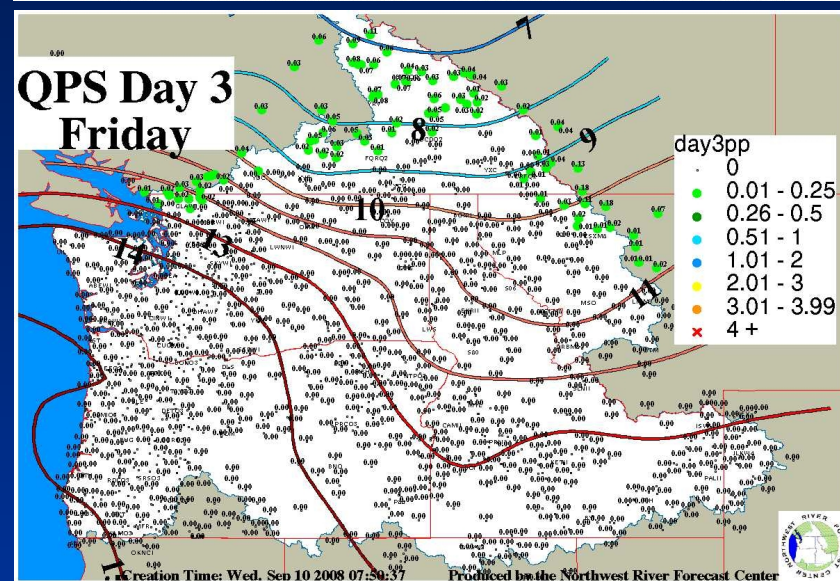
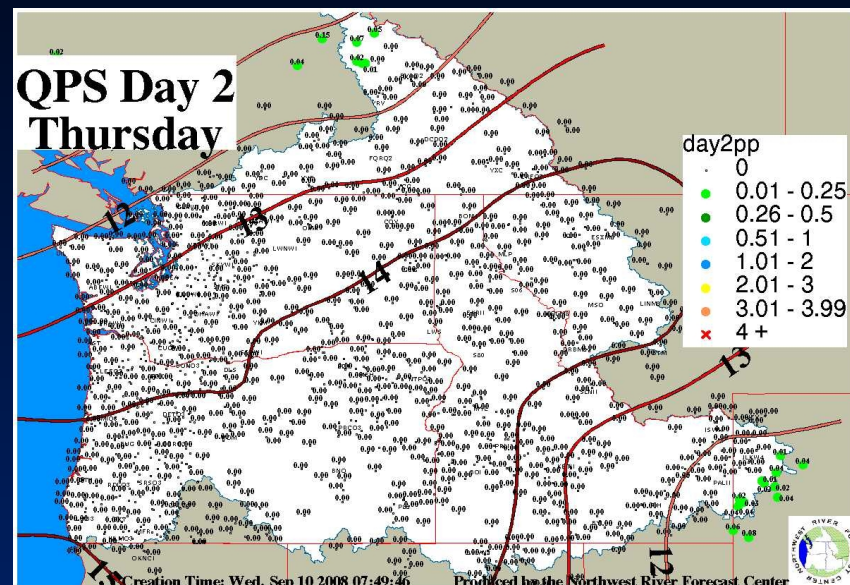
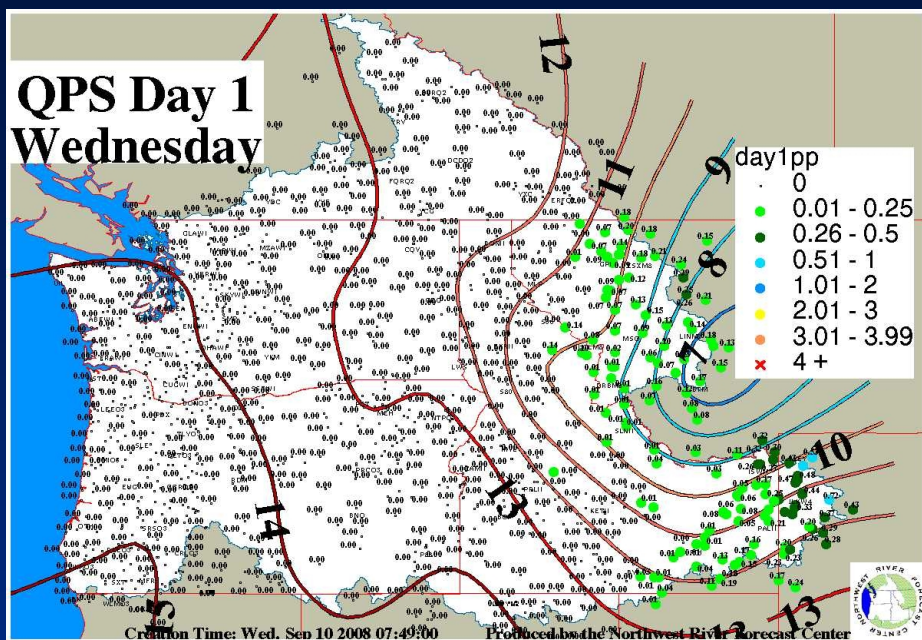
Day 2 (Wednesday) Min Temperature Forecast





Accessing Forecast Data Input

www.nwrfc.noaa.gov/weather/3_day.cgi





Accessing River Forecast Products

www.nwrfc.noaa.gov



River & Hydrology

Forecasts:
0 - 14 Days
14 - 120 Days
Water Supply
Peak Flow

Watch & Warnings
Flood Outlook
Discussion

Past Floods
River Photos
Dambreak
Hydrologic Cycle

Precip & Weather
Precipitation
Snow
Observations
MesoWest Obs
Forecasts
Exp Forecasts
Temp & Precip
Forecasts

Climate
Data and Indices
Climate Forecasts
El Nino and MJO
Hydroclimatology
Global Warming FAQ

Monthly Means
Return Periods

NWRFC Office
Information
Internal Web
SDM
Schedule
Staff
Employment
Projects
Papers
Presentations
Contact Us

Links
River Centers
Weather Offices
NWS Offices

WEB Statistics



River Forecasts and Data

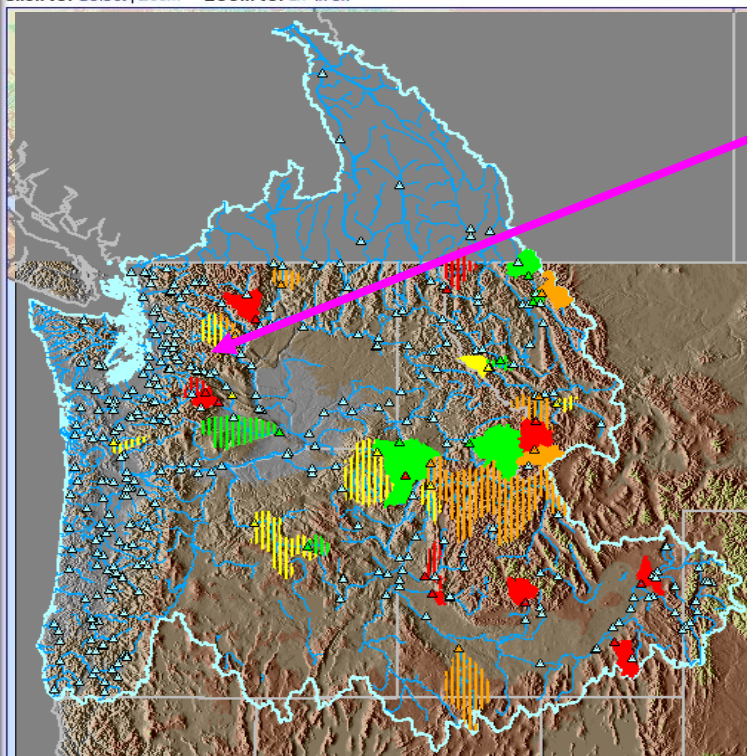
Map data updated 09/03.15:32 GMT, 09/03.08:32 PDT.
The following data are preliminary and is subject to change

New Please participate in the 2008 Hydrologic Services Survey -- click here

Click map on to zoom.

Click on Select Option for Station Info and Plots.

Click to: [Select](#) | [Zoom](#) **Zoom to:** 1x 4x 8x



Legend
Hydrologic Indicator
☐ 1 = Normal, 0 = No Data
☒ 2 = 80% of Bankfull
☒ 3 = 90% of Bankfull
☒ 4 = Above Bankfull
☒ 5 = Above Flood Stage
☐ Observed (Solid)
☐ Simulated (Striped)

Quick Plot

NWS ID

Layers

☒ Topography
☒ States
☒ RFC
☒ Rivers
☐ Basins
☒ Active Basins
☐ Data Points
☒ Forecast Points
☒ Active Points
☐ Point Labels

--Rivers--

Streams Observed or Forecasted to be Above a Minimum Criteria

Location	Id	Current Flow	Current Stage	Flood Stage	Bankfull Stage	Current Status	Forecasted
MOYIE - AT EASTPORT	EASI1 6100	8.9	9.00	8.00		96% Flood	110% Flood

Interactive Map

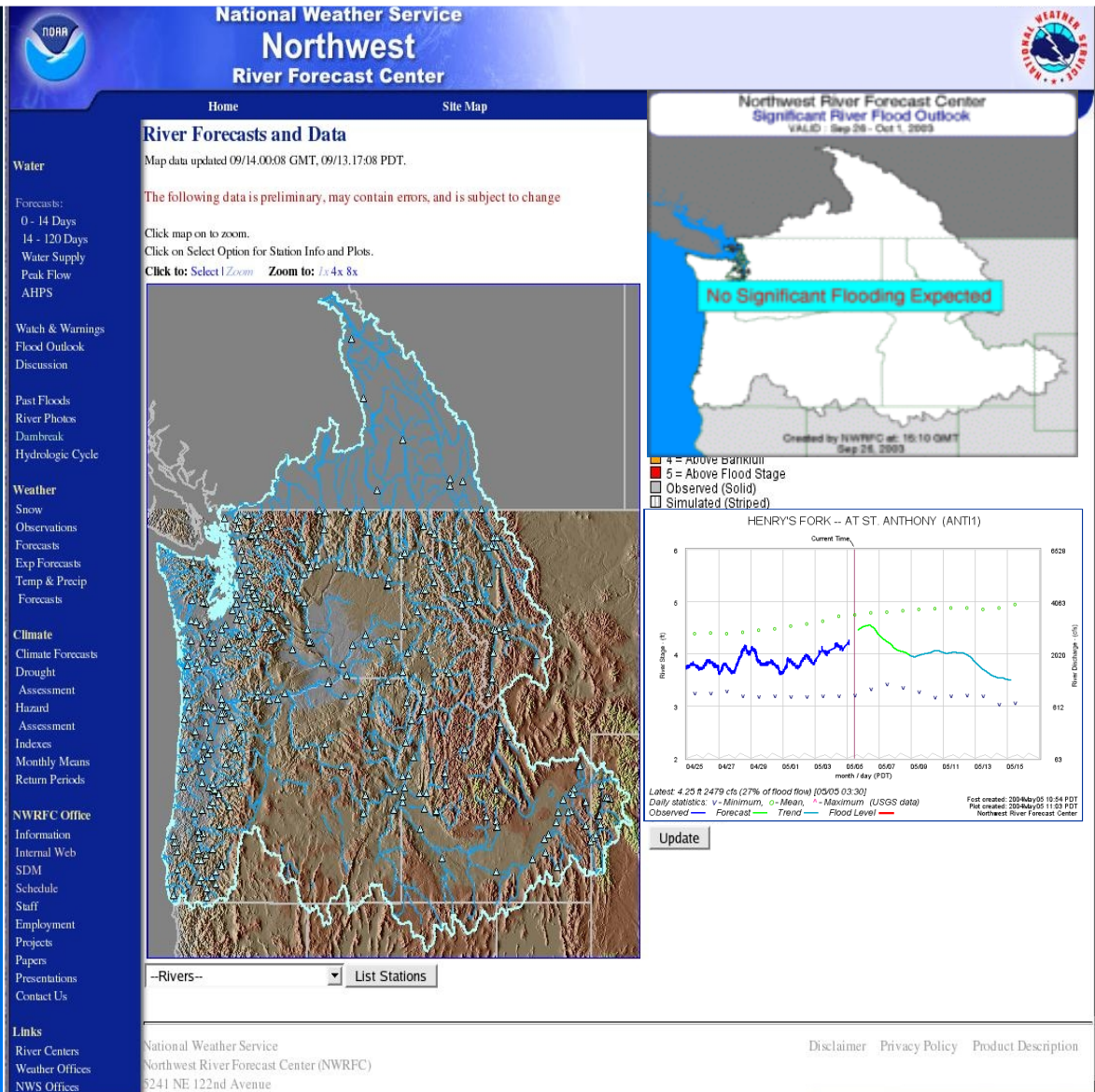
NWS ID

River List by Basin

Current Status

Northwest River Forecast Center

www.nwrfc.noaa.gov



Hydrometeorologic Discussion

HMD Text Product

Basin Summary:
River Conditions
Weather Condition

Rivers are expected to.....

**WFO issued
Warnings & Watches**

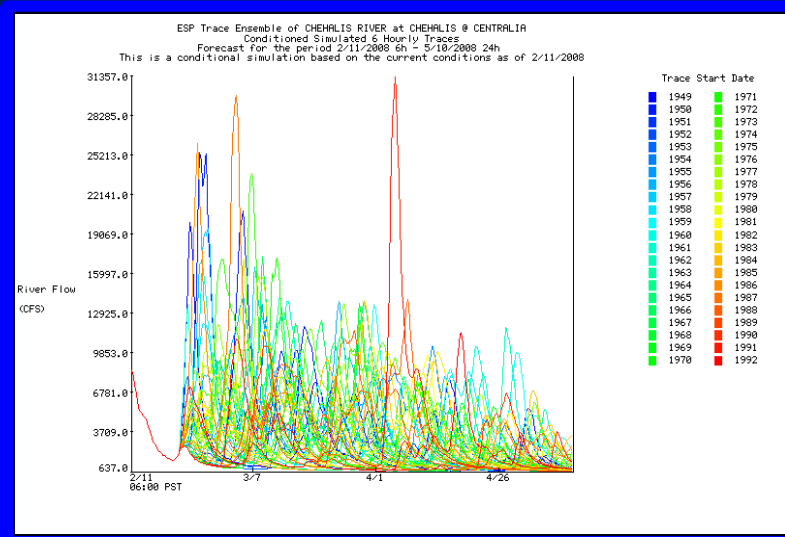
**The NWS has a Flood
Warning for....**

NWS Portland

www.wrh.noaa.gov/pqr/

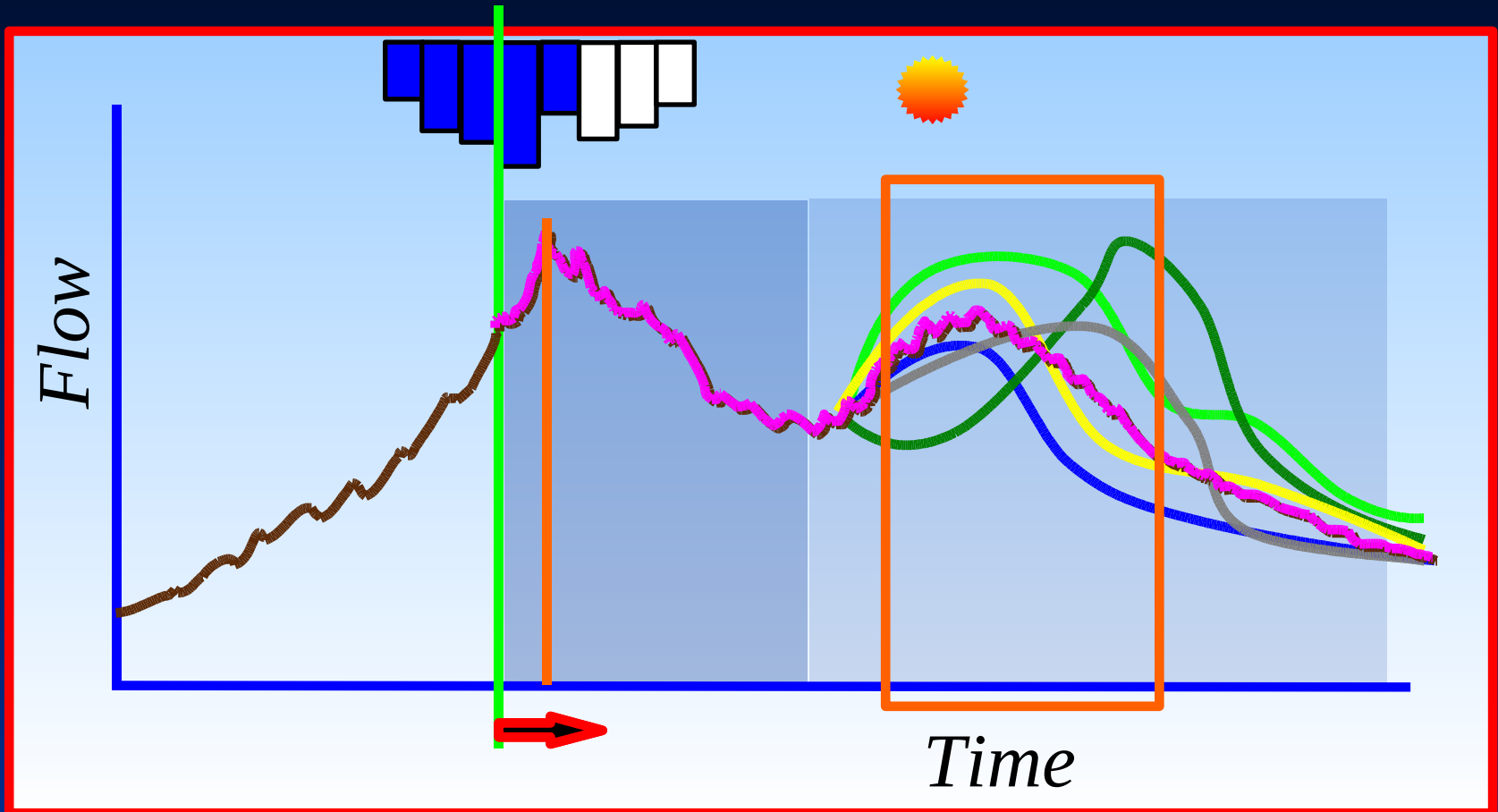


Hydrologic Long Term Forecasts





NWRFC Forecast Products



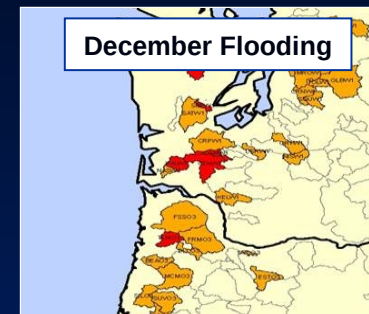


Elements of a Long-term Forecast



Statement of Hydrologic Event:

Which rivers are forecasted to flood?
What is the maximum expected flood?
What seasonal flow volume is expected?



Timing of Event:

Will it flood this month or next?
When are low flows expected?
What is the season of maximum runoff?



Confidence of Forecast:

What is the likely *range* of flows?
What are the *chances* of flooding?
When is the *most likely period* of flooding?

Thursday



20%
Slight Chc
Showers
Hi 81°F



November



20%
Slight Chc
Flooding



Long-term Forecasting Drivers



Soil Moisture



Snowpack



Precipitation

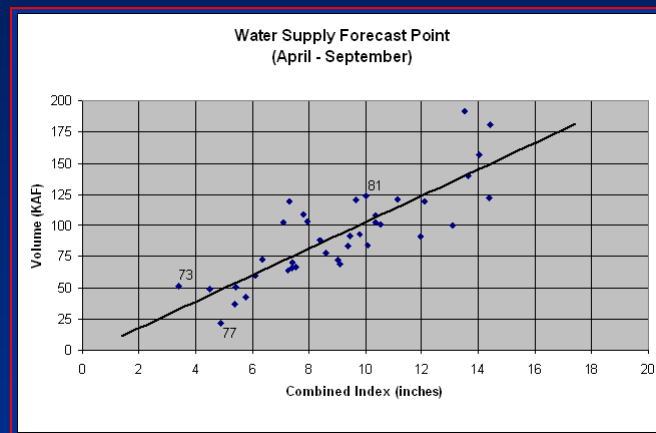


NWRFC Forecasting Models



Statistical Water Supply Model

- **Seasonal Volumetric Forecasts**
 - Regression techniques
 - Agency Coordinated (consensus)





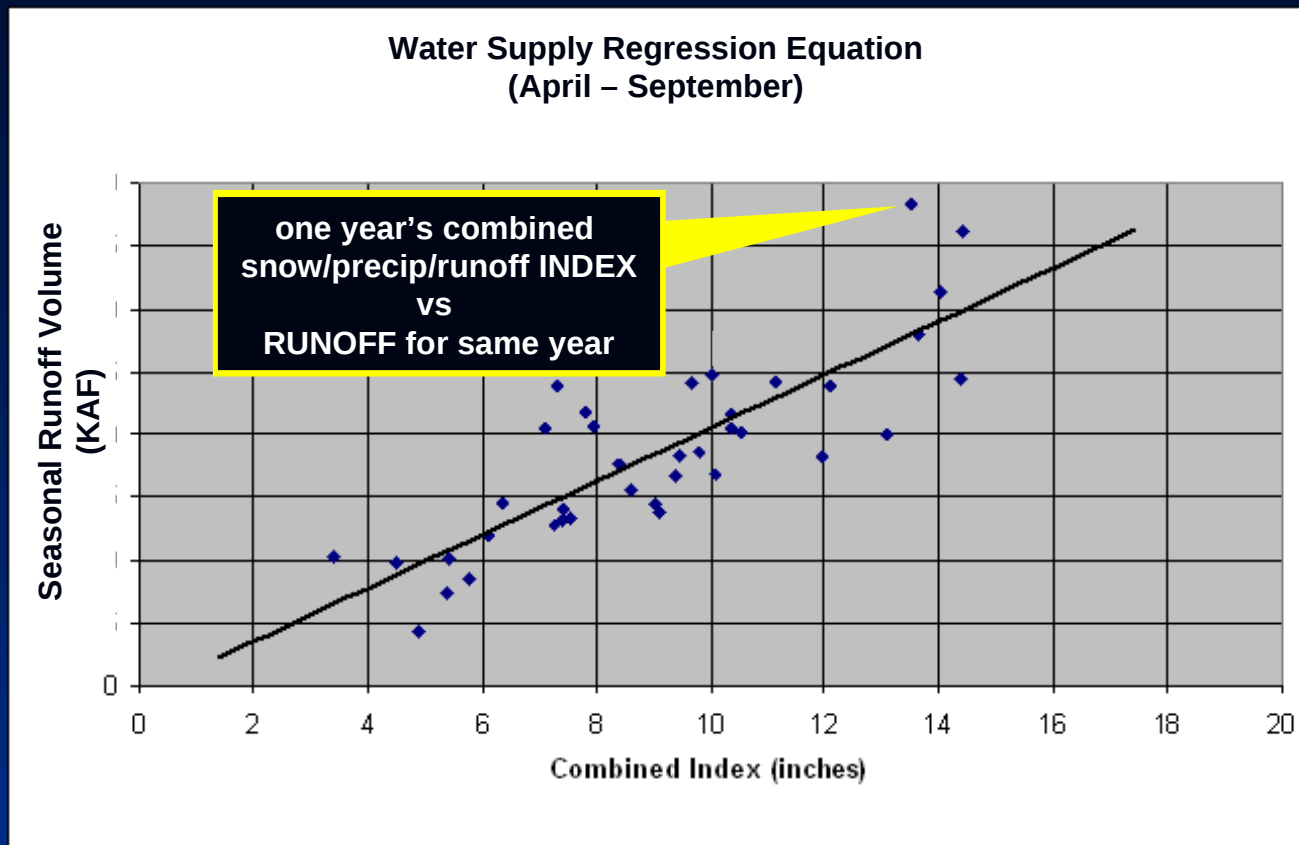
Statistical Water Supply Regression Model Development



Combined Index:
Historical Precip
Historical Snow
Historical Runoff
Historical Precip

Plotted Against

Historical
Runoff Volume





Statistical Water Supply

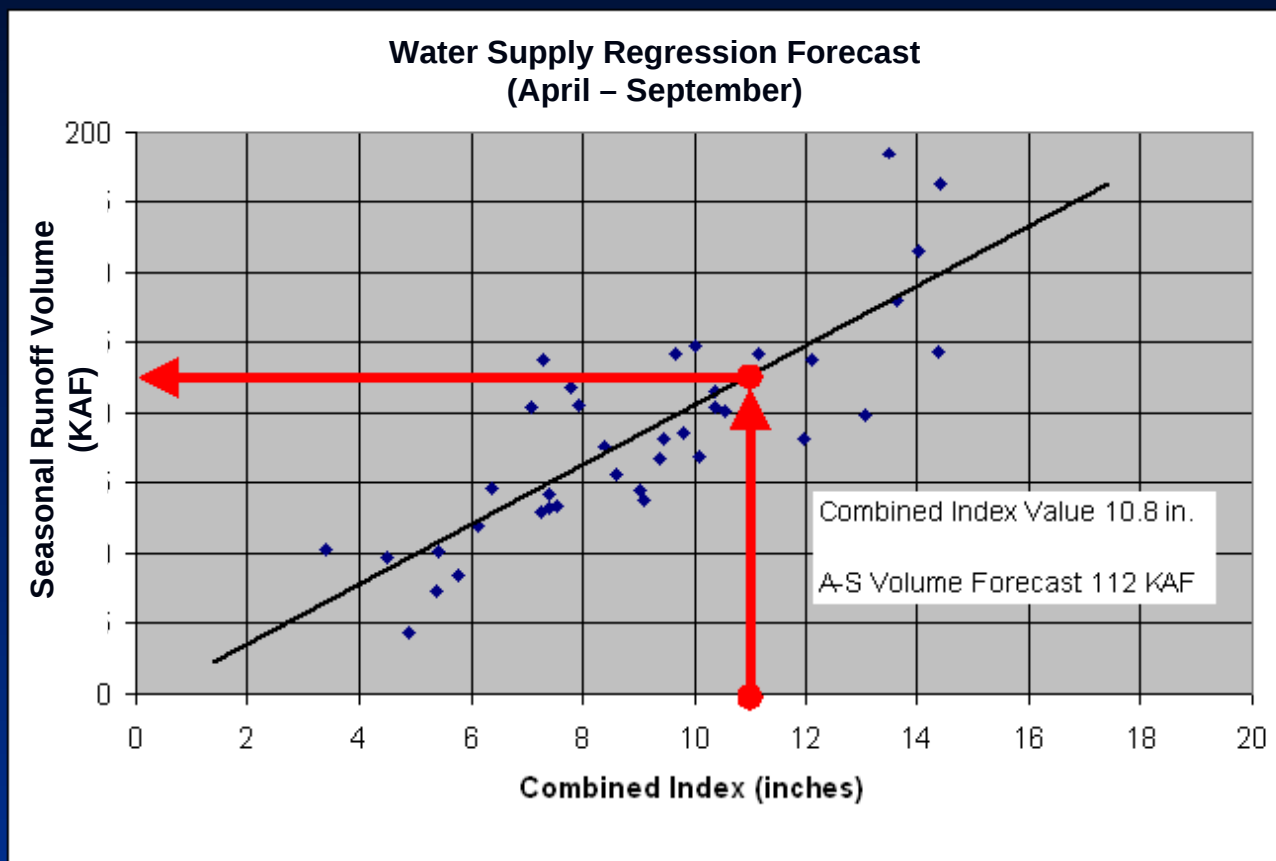
Seasonal Volume Forecast



Forecast
Runoff Volume

is a function of

Combined Index:
Observed Precip
Observed Snow
Observed Runoff
Future Precip





Water Supply Forecast Products

http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi



River & Hydrology

Forecasts:

0 - 14 Days

14 - 120 Days

Water Supply

Peak Flow

Watch & Warnings
Flood Outlook
Discussion

Past Floods
River Photos
Dambreak
Hydrologic Cycle

Precip & Weather

Precipitation

Snow

Observations

MesoWest Obs

Forecasts

Exp Forecasts

Temp & Precip

Forecasts

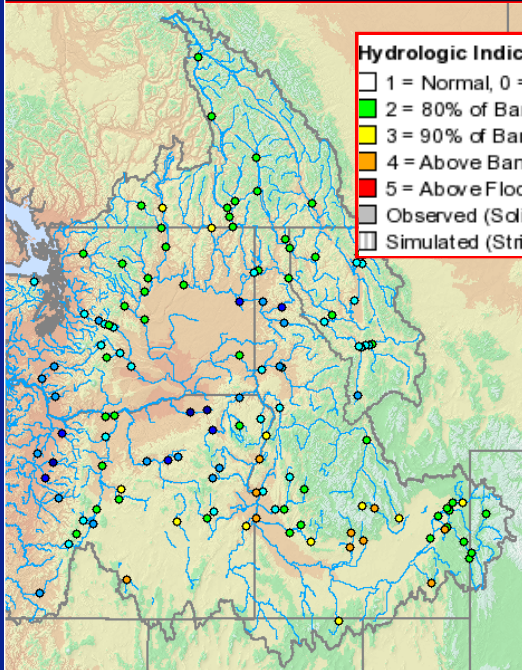
Climate

Data and Indices

Climate Forecasts

El Nino and MJO

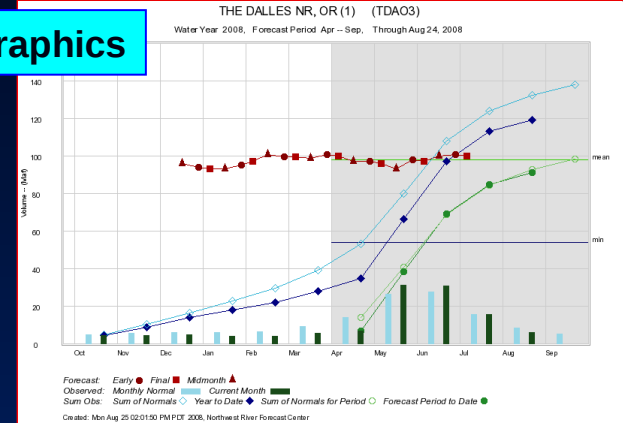
Hydroclimatology



Hydrologic Indicator

- 1 = Normal, 0 = No Data
- 2 = 80% of Bankfull
- 3 = 90% of Bankfull
- 4 = Above Bankfull
- 5 = Above Flood Stage
- Observed (Solid)
- Simulated (Striped)

Graphics



Tables

Official Forecast (Regression) Issued: 2007-07-09 (Description)						
	forecast (KAF)	% of Average	5% Forecast	95% Forecast	30yr (1971-2000) Average	Max of Record Min of Record
JAN-SEP	74300.0	102	80090.0	68510.0	73040.0	103500.0 44000.0
JUL-SEP	21900.0	100	27690.0	16110.0	21930.0	
APR-JUL	53000.0	98	58790.0	47210.0	53850.0	76239.0 31885.0
APR-SEP	63300.0	99	69090.0	57510.0	63990.0	88512.0 39829.0
JAN-JUL	64000.0	102	69790.0	58210.0	62900.0	91140.0 34760.0
APR-AUG	59600.0	99	65390.0	53810.0	60290.0	84080.0 37442.0
JAN-AUG	70500.0	102	76290.0	64710.0	69340.0	
JUL-AUG	18100.0	99	23890.0	12310.0	18230.0	

Text Products

Stream and Station		Forecast					
		Probable	%	Maximum	%	Minimum	%
COLUMBIA RIVER							
MICA RESERVOIR INFLOW, BC		JAN-JUL	9970.0	104	11200.0	116	8700.0 90
		FEB-SEP	13400.0	103	14700.0	113	12100.0 93
		APR-SEP	13000.0	104	14200.0	114	11700.0 94
REVELSTOKE, BC		JAN-JUL	14300.0	103	15200.0	110	13200.0 95
ARROW LAKES INFLOW		JAN-JUL	20700.0	99	22500.0	107	18800.0 90



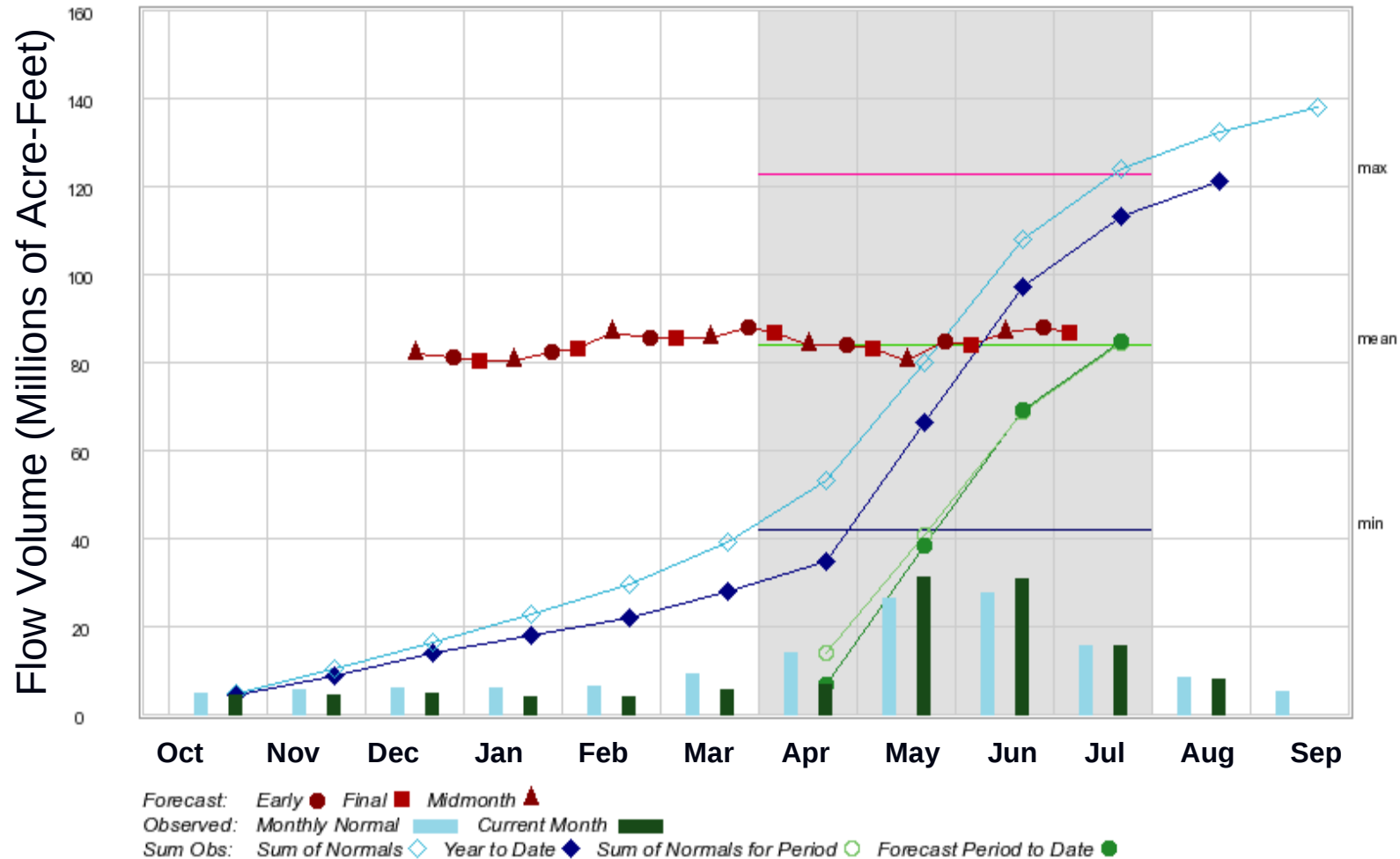
Water Supply Forecast Plot

http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi



THE DALLES NR, OR (1) (TDAO3)

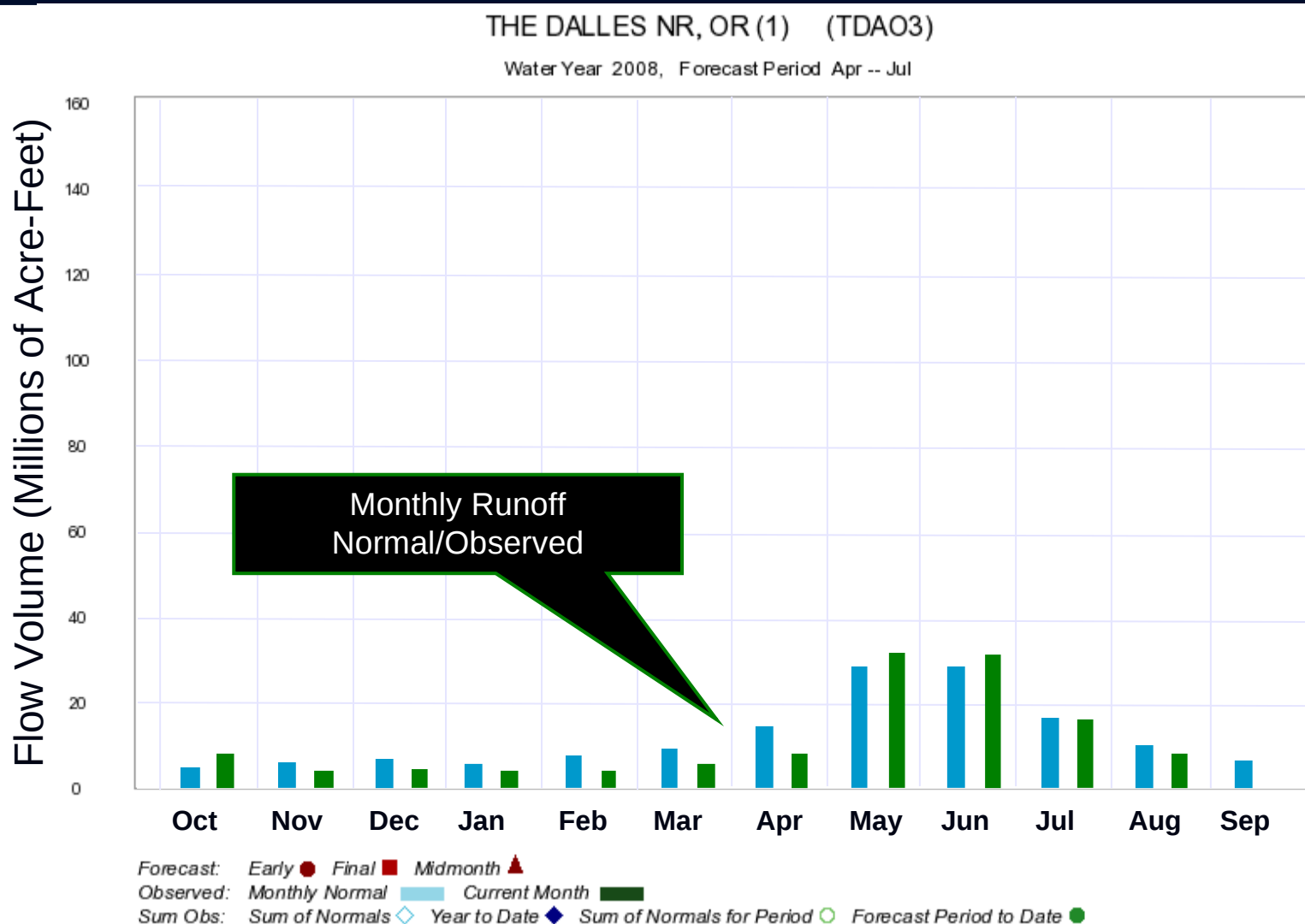
Water Year 2008, Forecast Period Apr -- Jul





Water Supply Forecast Plot

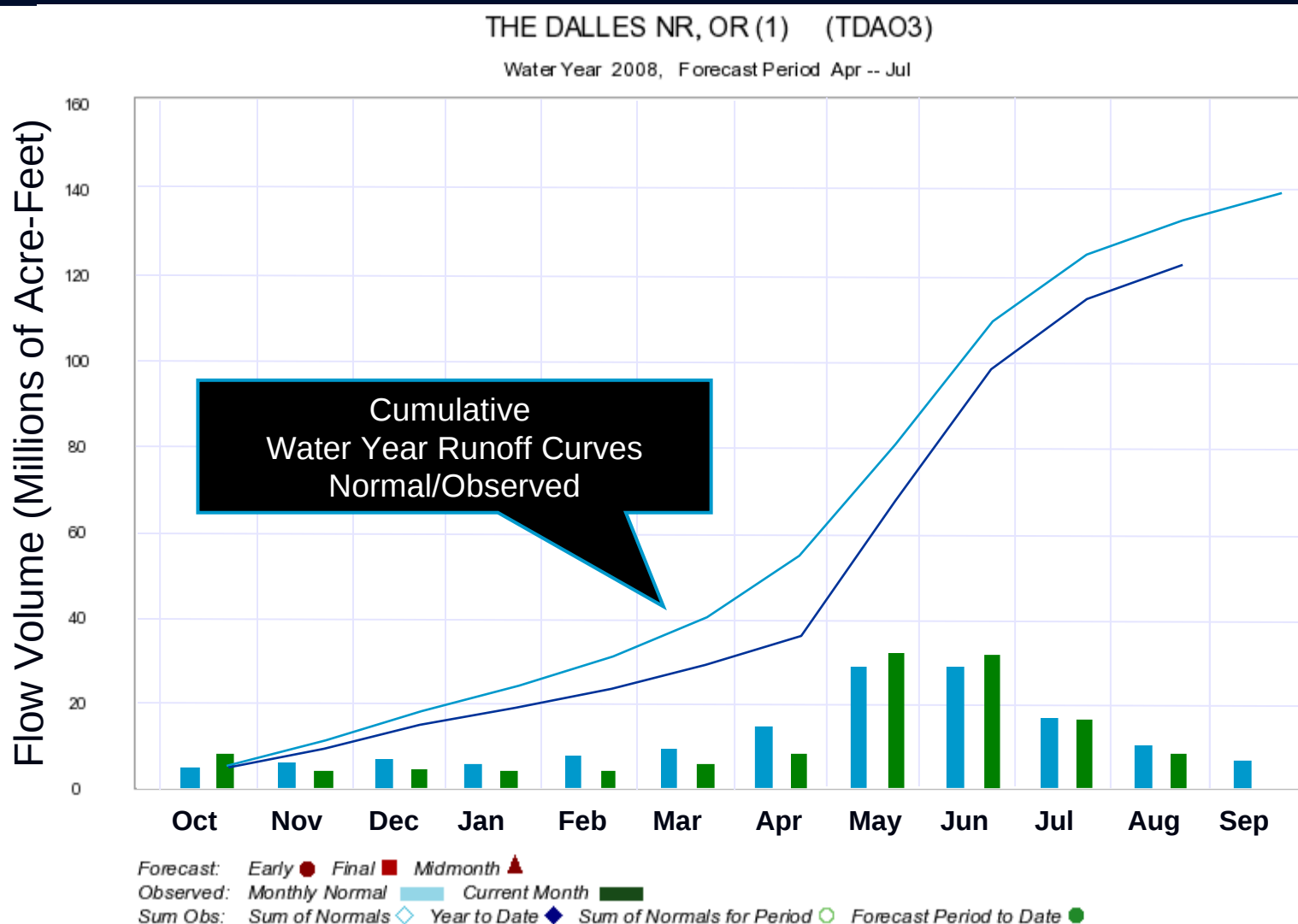
http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi





Water Supply Forecast Plot

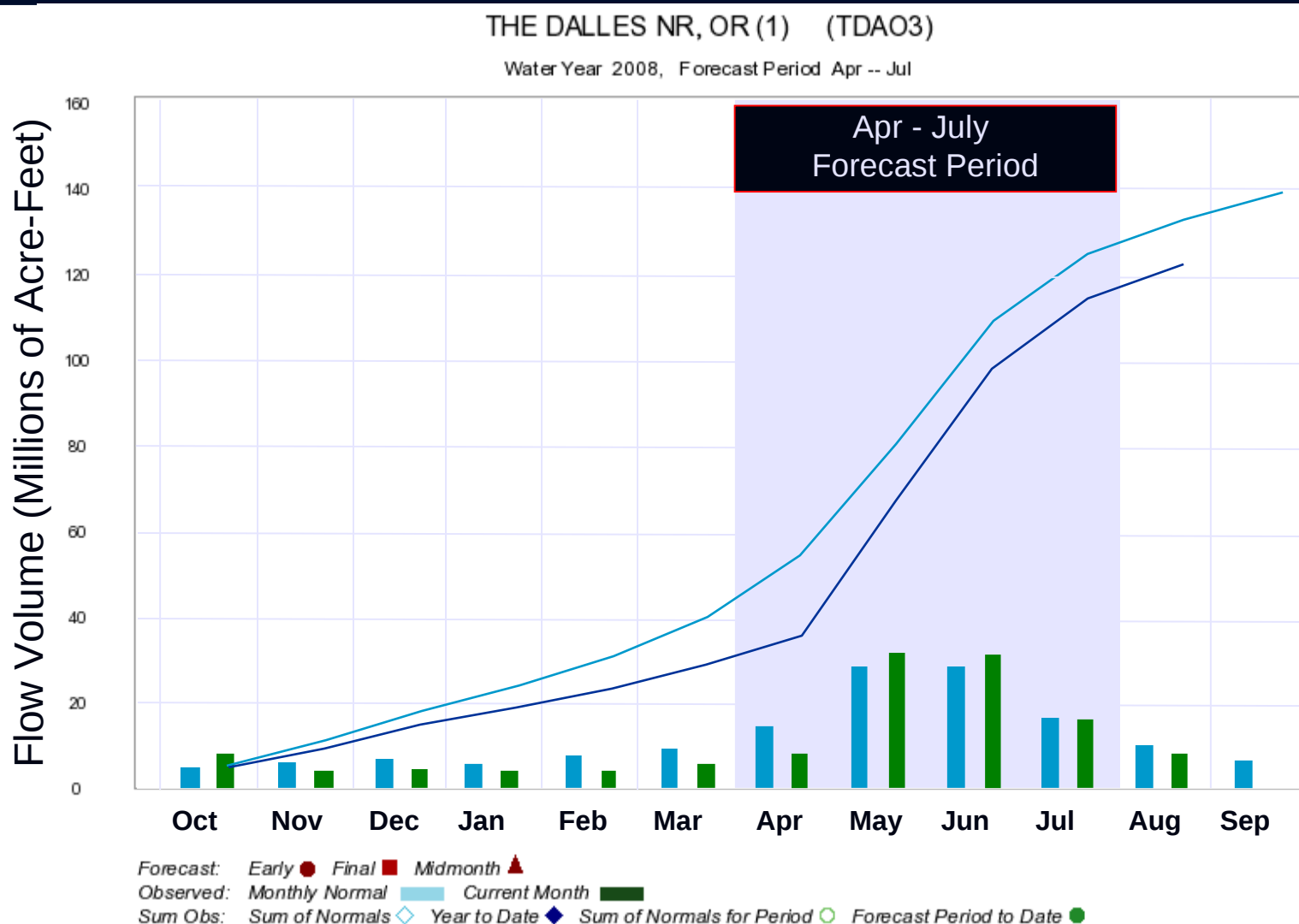
http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi





Water Supply Forecast Plot

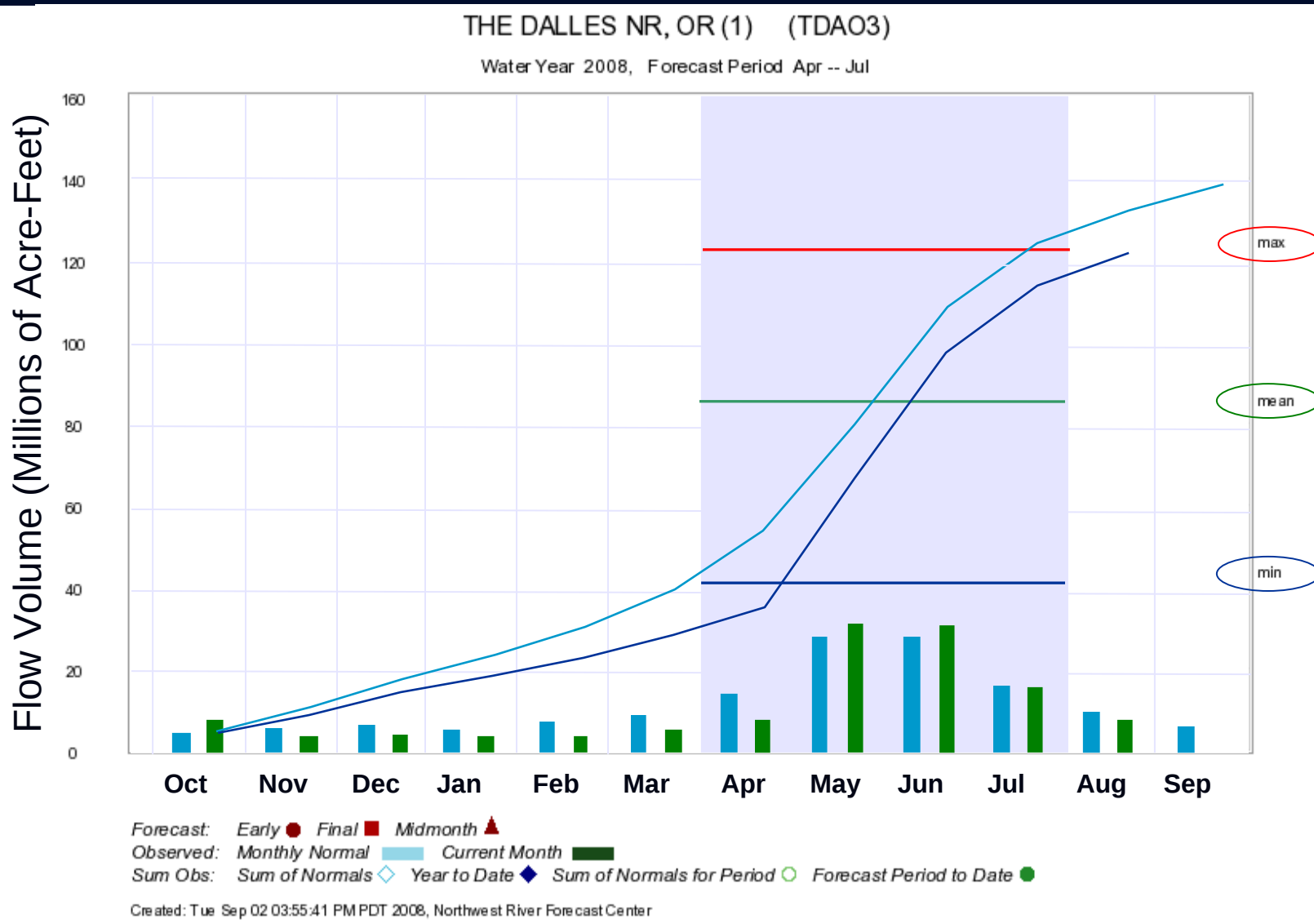
http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi





Water Supply Forecast Plot

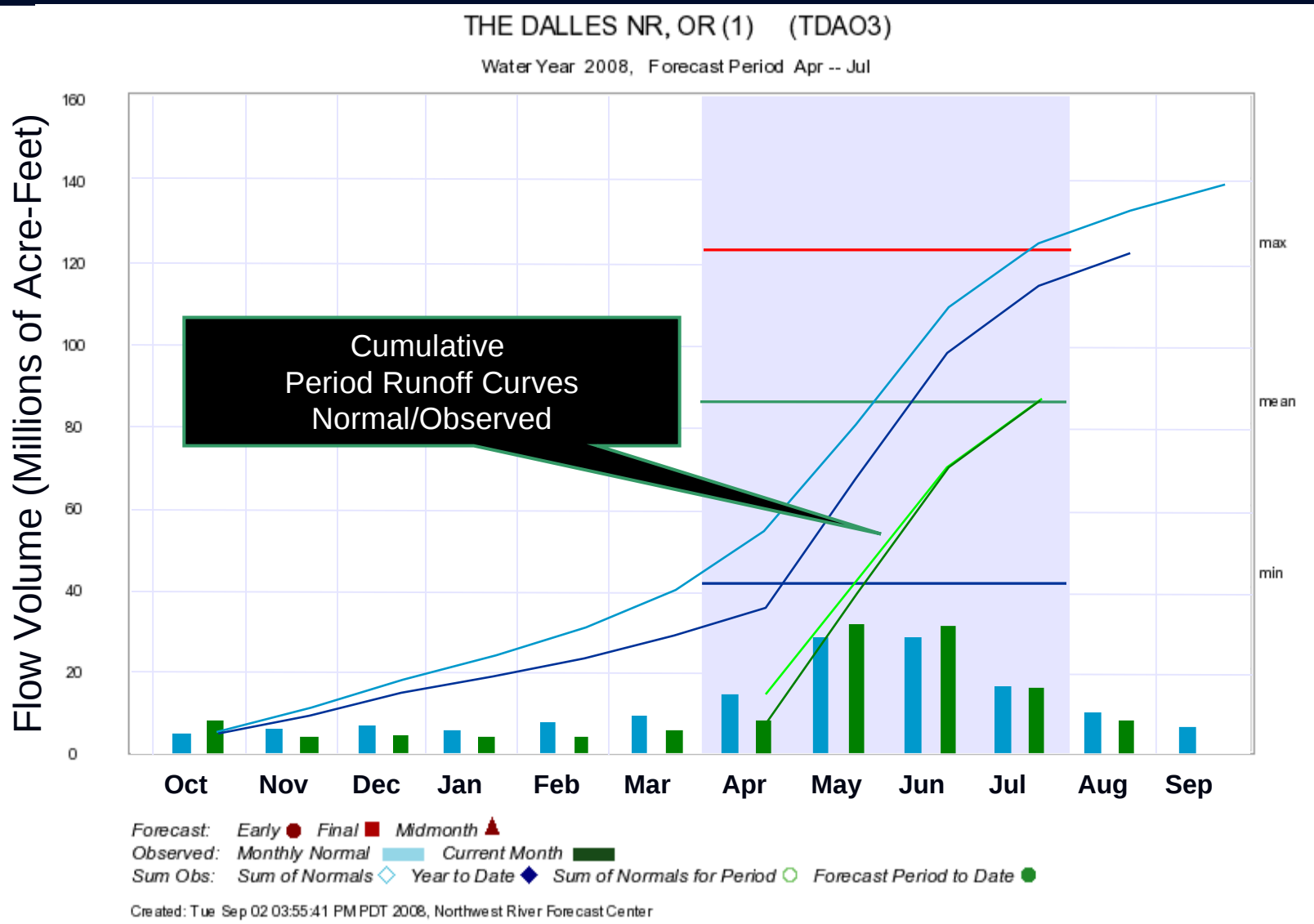
http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi





Water Supply Forecast Plot

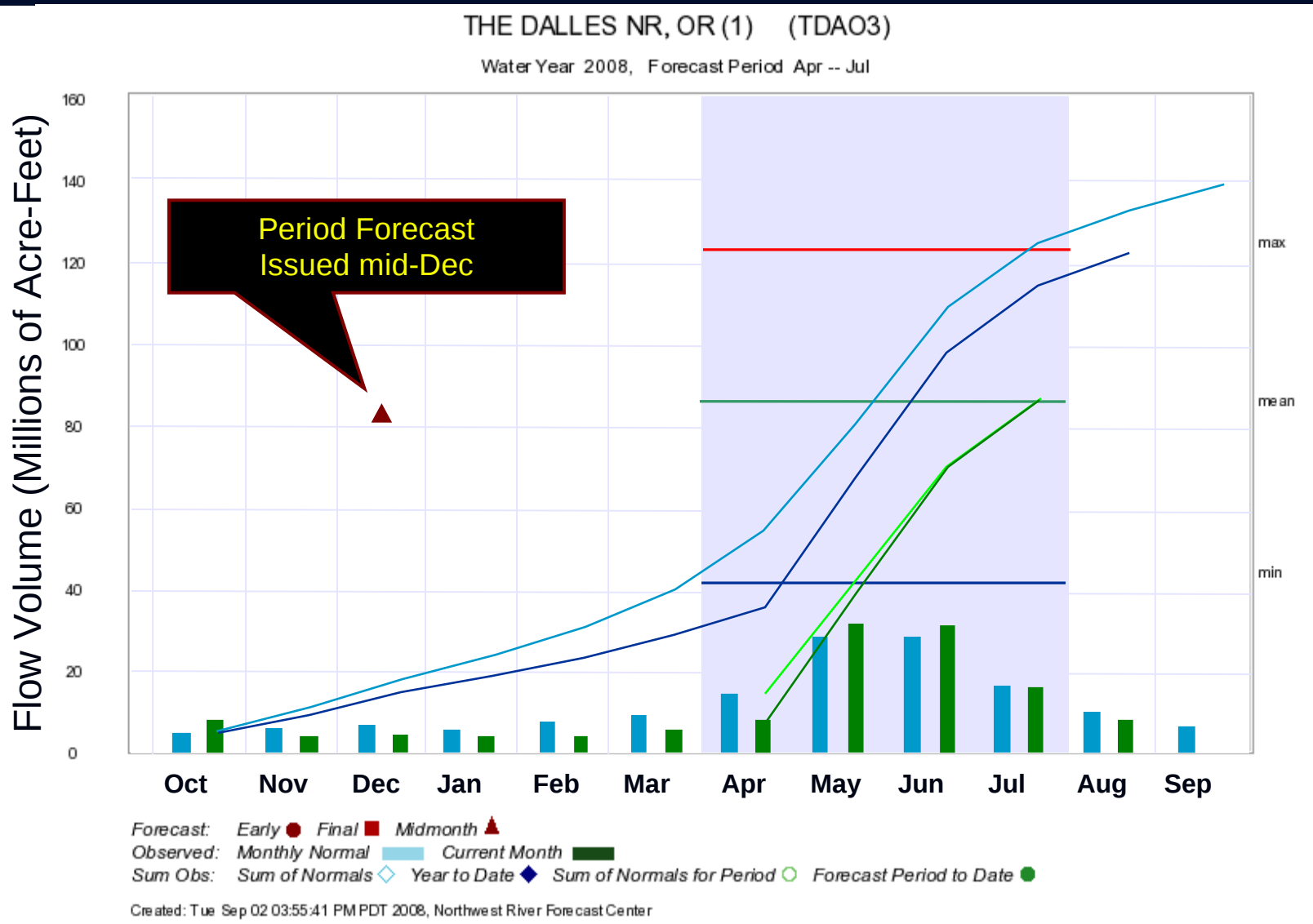
http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi





Water Supply Forecast Plot

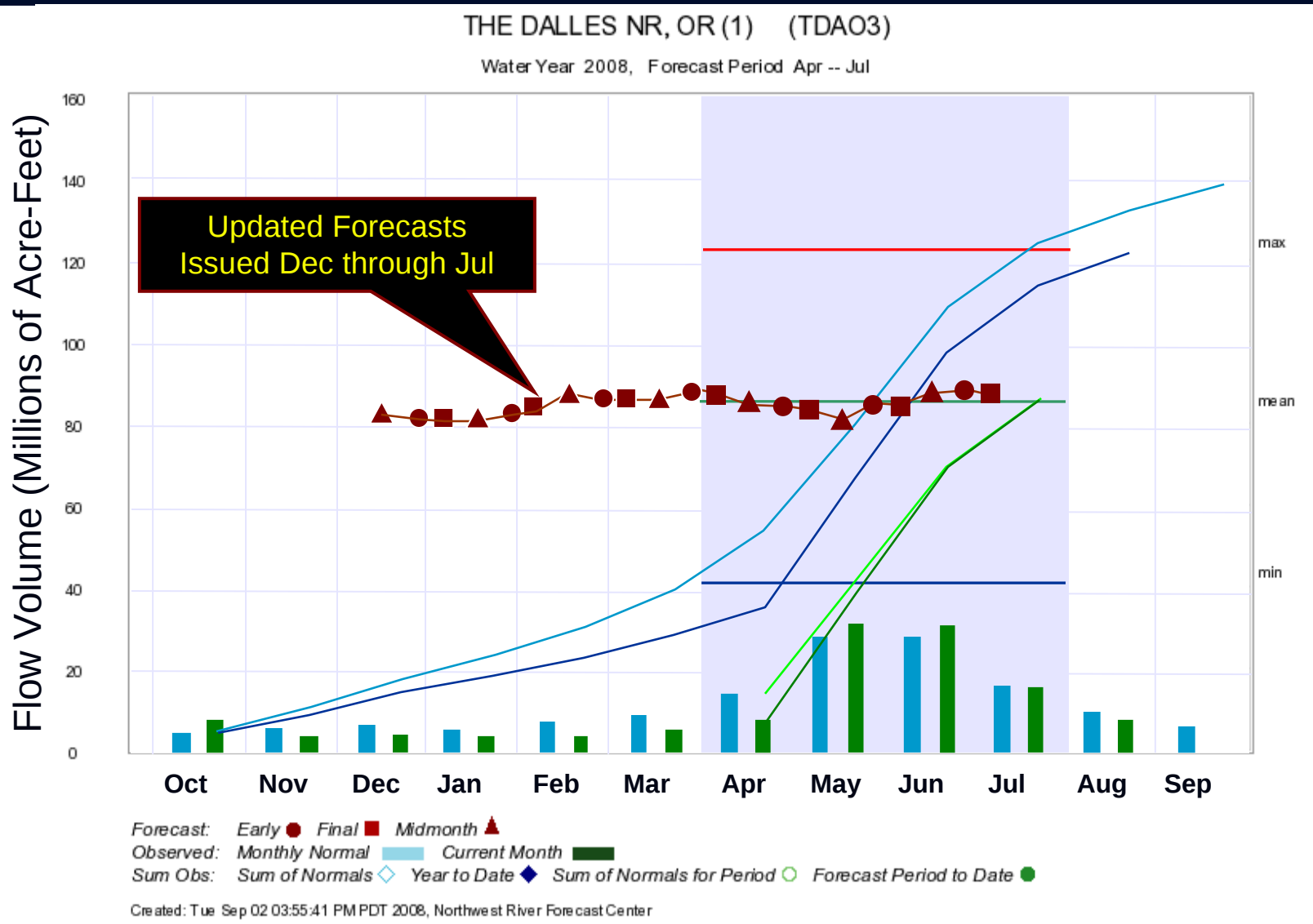
http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi





Water Supply Forecast Plot

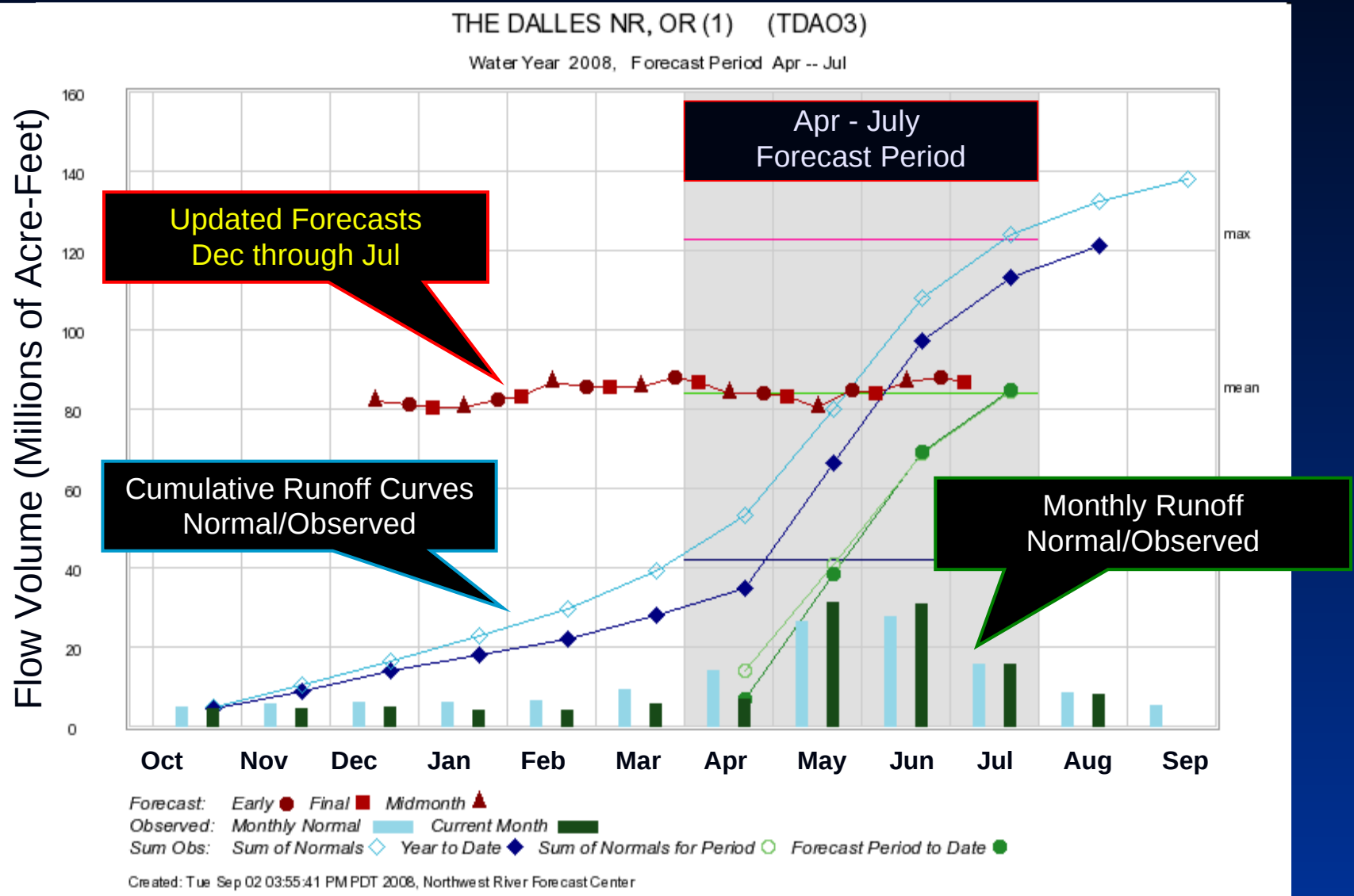
http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi

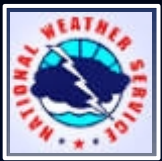




Water Supply Forecast Plot

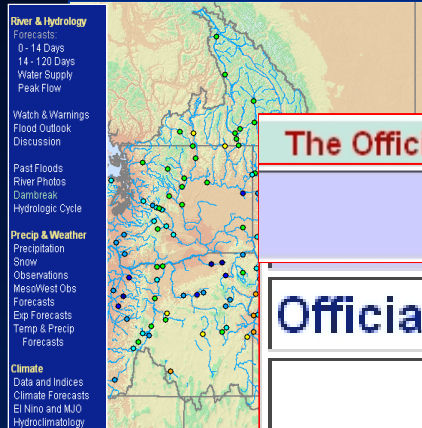
http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi





Water Supply Forecast Table

http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi



The Official Statistical Water Supply forecast is issued between the middle of December and July 1st.

COLUMBIA - THE DALLES DAM (TDA03)
Forecasts for WY 2008

Official Forecast (Regression) <i>Issued: 2008-07-08</i> {Description}							
Period	Forecast (KAF)	% of Average	5% Forecast	95% Forecast	30yr (1971-2000) Average	Max of Record	Min of Record
JAN-SEP	114000.0	94	122270.0	105730.0	121300.0	176593.0	64517.0
JUL-SEP	30700.0	103	38970.0	22430.0	29810.0		
APR-AUG	94700.0	102	102970.0	86430.0	93090.0	133733.0	49445.0
JAN-AUG	109000.0	94	117270.0	100730.0	115700.0	168669.0	59871.0
JUL-AUG	25700.0	106	33970.0	17430.0	24240.0		
APR-SEP	100000.0	101	108270.0	91730.0	98650.0	141056.0	54091.0
JAN-JUL	101000.0	94	109270.0	92730.0	107300.0	159000.0	53359.0
APR-JUL	87000.0	103	95270.0	78730.0	84650.0	123463.0	42933.0



Water Supply Text Forecast

http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi

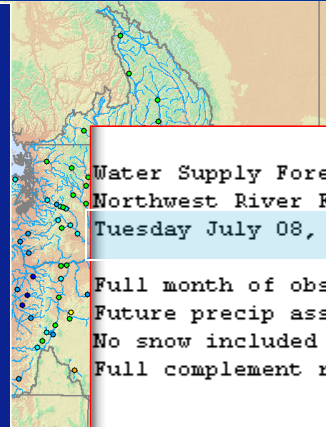
River & Hydrology
Forecasts
0-14 Days
14-120 Days
Water Supply
Peak Flow

Watch & Warnings
Flood Outlook
Discussion

Past Floods
River Photos
Dambreak
Hydrologic Cycle

Precip & Weather
Precipitation
Snow
Observations
MesoWest Obs
Forecasts
Exp Forecasts
Temp & Precip
Forecasts

Climate
Data and Indices
Climate Forecasts
El Nino and MJO
Hydroclimatology



Water Supply Forecasts

Northwest River Forecast Center

Tuesday July 08, 2008 at 20:50 GMT

Full month of observed precipitation

Future precip assumed to be normal

No snow included

Full complement runoff applied through JUN

UPPER COLUMBIA BASINS

Jul-08 Final

Stream and Station

COLUMBIA RIVER

MICA RESERVOIR INFLOW, BC

JAN-JUL

9970.0 104

FEB-SEP

13400.0 103

APR-SEP

13000.0 104

REVELSTOKE, BC

JAN-JUL

14300.0 103

ARROW LAKES INFLOW

JAN-JUL

20700.0 99

FEB-SEP

26200.0 99

APR-SEP

25300.0 101

BIRCHBANK, BC (1)

JAN-JUL

37400.0 96

APR-SEP

42500.0 98

GRAND COULEE, WA (1)

JAN-JUL

61300.0 97

APR-SEP

65300.0 102

ROCK ISLAND DAM BLO, WA (1)

JAN-JUL

67700.0 98

APR-SEP

71800.0 103

THE DALLES NR, OR (1)

JAN-JUL

101000.0 94

APR-AUG

94700.0 102

APR-SEP

100000.0 101

Select Recent Regression Text Forecast

Year	Month	Early Bird	Final	Mid Month
2008	Jul	06-26-2008	07-08-2008	
2008	Jun	05-29-2008	06-06-2008	06-20-2008
2008	May	05-01-2008	05-07-2008	05-16-2008
2008	Apr	03-27-2008	04-07-2008	04-17-2008
2008	Mar	02-28-2008	03-07-2008	03-13-2008
2008	Feb	01-31-2008	02-07-2008	02-14-2008
2008	Jan	12-28-2008	01-08-2008	01-17-2008

Forecast

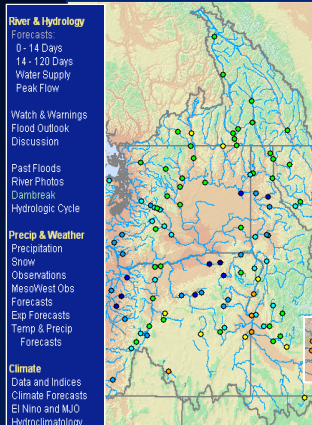
Runoff

Stream and Station			Probable	%	Maximum	%	Minimum	%	Average	PrevYr	CurYR	%
COLUMBIA RIVER												
MICA RESERVOIR INFLOW, BC		JAN-JUL	9970.0	104	11200.0	116	8700.0	90	9619.	9985	7327	96
		FEB-SEP	13400.0	103	14700.0	113	12100.0	93	12960.	12300	7327	96
		APR-SEP	13000.0	104	14200.0	114	11700.0	94	12500.	11850	7327	96
REVELSTOKE, BC		JAN-JUL	14300.0	103	15200.0	110	13200.0	95	13880.	14190	11040	98
ARROW LAKES INFLOW		JAN-JUL	20700.0	99	22500.0	107	18800.0	90	20960.	20790	16460	91
		FEB-SEP	26200.0	99	28100.0	106	24400.0	92	26460.	24050	16460	91
		APR-SEP	25300.0	101	27100.0	108	23500.0	94	25110.	22920	16460	91
BIRCHBANK, BC (1)		JAN-JUL	37400.0	96	41500.0	107	33300.0	86	38930.	41180	32470	93
		APR-SEP	42500.0	98	46600.0	107	38400.0	88	43500.	42860	32470	93
GRAND COULEE, WA (1)		JAN-JUL	61300.0	97	67100.0	107	55500.0	88	62900.	66890	55440	93
		APR-SEP	65300.0	102	71100.0	111	59500.0	93	63990.	63870	55440	93
ROCK ISLAND DAM BLO, WA (1)		JAN-JUL	67700.0	98	74600.0	108	60800.0	88	68910.	71930	59550	91
		APR-SEP	71800.0	103	78700.0	113	64900.0	93	69540.	68910	59550	91
THE DALLES NR, OR (1)		JAN-JUL	101000.0	94	109000.0	102	92600.0	86	107300.	114700	97340	90
		APR-AUG	94700.0	102	103000.0	111	86500.0	93	93090.	97540	97340	90
		APR-SEP	100000.0	101	109000.0	110	92100.0	93	98650.	101700	97340	90



Water Supply Release Schedule

http://www.nwrfc.noaa.gov/water_supply/ws_fcst.cgi

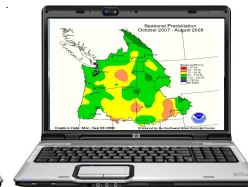
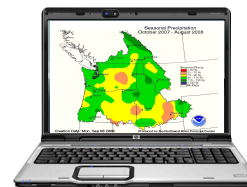
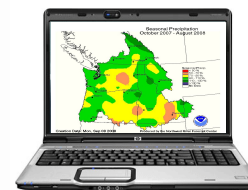
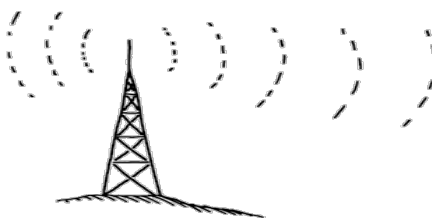


Water Supply Forecast Release Schedule for 2008-2009 WY								
Type of Forecast	Month							
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Early Bird (Prelim Forecast)		2,29	26		2,30	29		2
Official Forecast (Final)		8	6	6	7	7	5	8
Peak Flow Forecast		9	9	9	8	8	8	9
Mid-month Update	18	23	20	19	23	21	18	
Live Call		9	9	9	8	8	8	9

Normal Release Time is in the Afternoon on Days Listed



Monthly Water Supply Live Call / Webinar



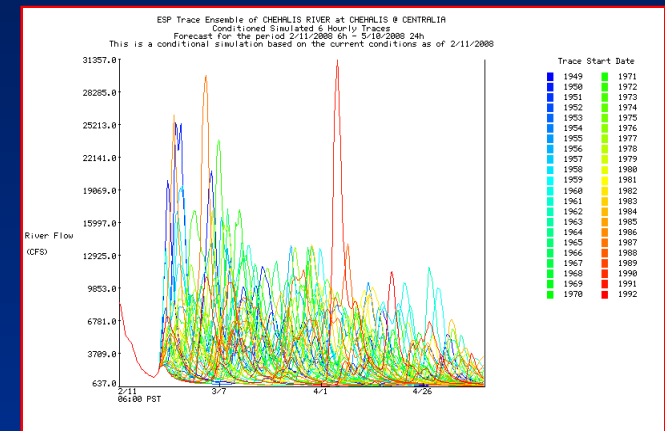


NWRFC Forecasting Models



Ensemble Streamflow Prediction (ESP)

- Short, Medium, and Longterm capabilities
 - Variation on NWRFC short-term modeling system
 - Provides an ensemble of possible outcomes
 - Issued as a probability forecast



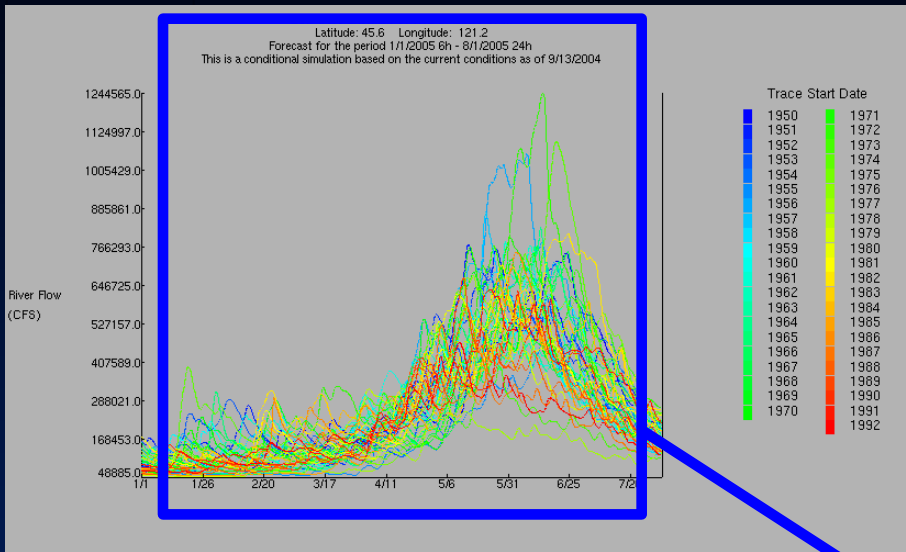
ESP

Example showing 42 **trace** outcomes for
The Columbia River at The Dalles, OR

Runtime conditions: 9/13/2004

Analysis period: 1/1/2005-8/1/2005

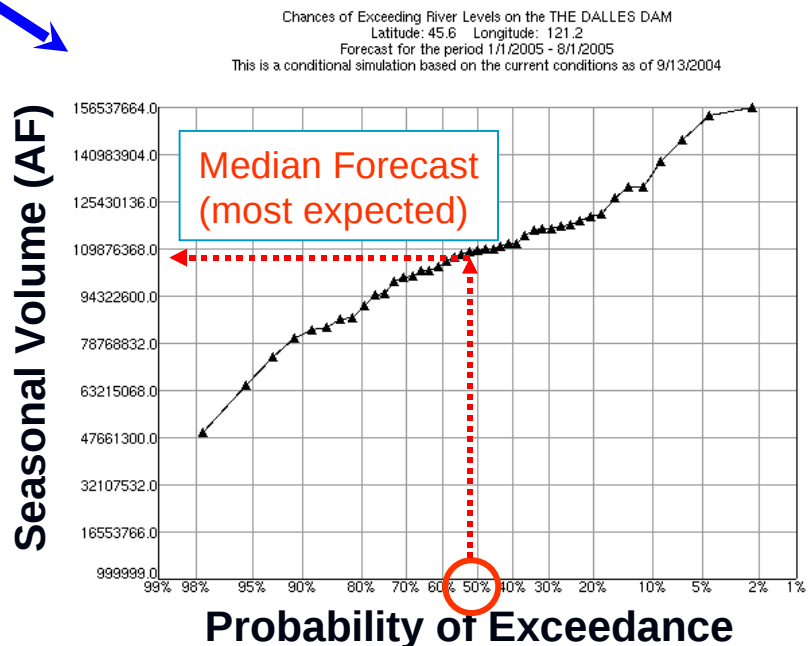
Traces represent **ensemble** of possible
river flow behavior (Jan-Jul)



Exceedance Probability Plot:

Ranked flow volumes (each point represents area under individual ensemble traces) for Jan-Jul period.

50% Value is comparable
to WS forecasts





ESP Forecast Products

<http://www.nwrfc.noaa.gov/espws/espws.cgi>



River & Hydrology

Forecasts:

0 - 14 Days

14 - 120 Days

Water Supply

Peak Flow

Watch & Warnings

Flood Outlook

Discussion

Past Floods

River Photos

Dambreak

Hydrologic Cycle

Precip & Weather

Precipitation

Snow

Observations

MesoWest Obs

Forecasts

Exp Forecasts

Temp & Precip

Forecasts

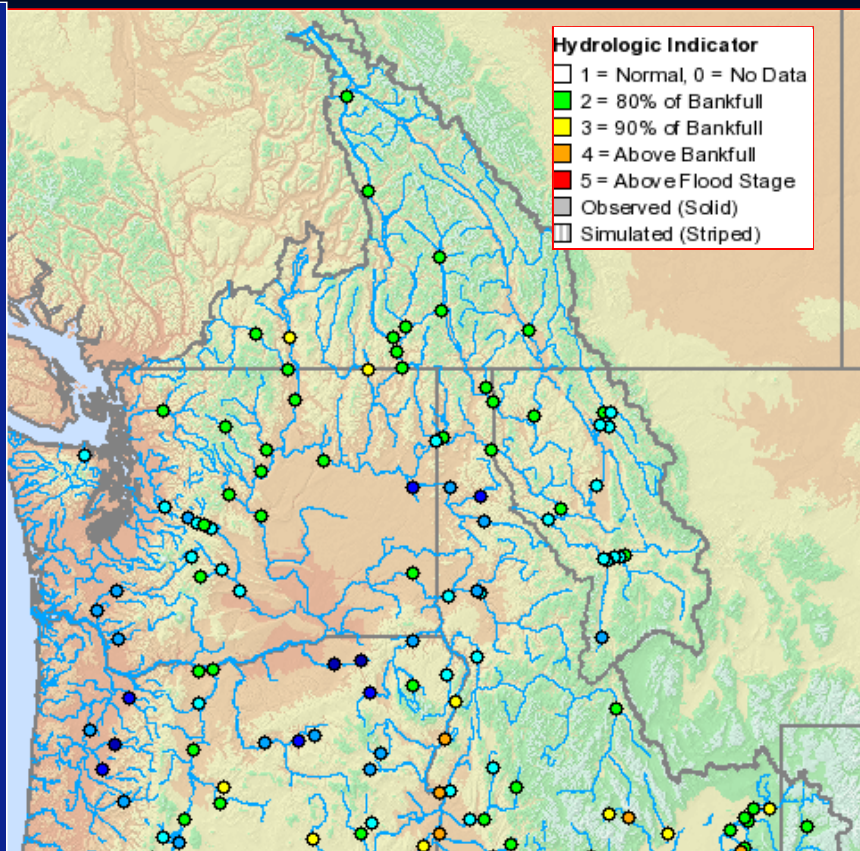
Climate

Data and Indices

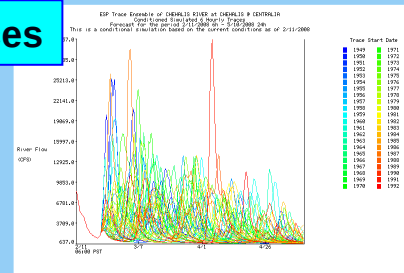
Climate Forecasts

El Nino and MJO

Hydroclimatology



Traces

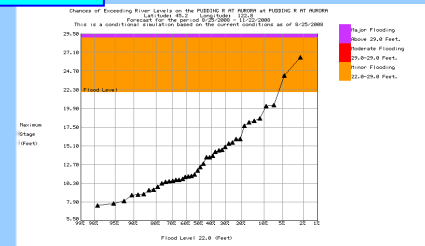
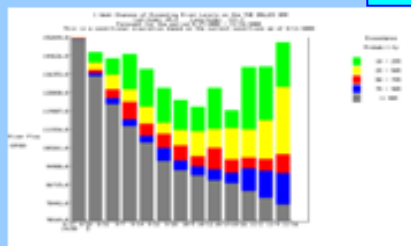
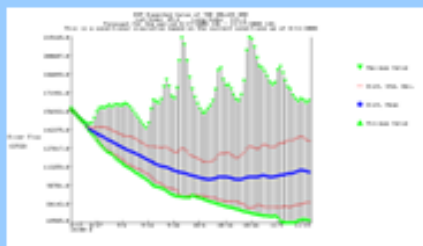


Tables

Forecasts Issued: 2007-09-25

Forecast Period	ESP Forecasts for Forecast Period (94F)				
	90 % Exceedance Probability	70 % Exceedance Probability	50 % Exceedance Probability	30 % Exceedance Probability	10 % Exceedance Probability
JAN-SEP	70850.4	70850.4	70850.4	70850.4	70850.5
JUL-SEP	18420.4	18420.4	18420.4	18420.4	18420.5
APR-SEP	59872.4	59872.4	59872.4	59872.4	59872.5

Graphics







ESP Interactive Ensemble Analyzer

<http://www.nwrfc.noaa.gov/espdp/espdp.cgi>



Water Supply Forecast Information

Summary
Western Water Supply

ESP Water Supply
ESP Natural
ESP Interactive

Peakflow

Description
Verification

Inputs

Precipitation
Temperature
Snow
Runoff

Descriptive Information

Summary
Schedule
Fest Locations
Publications

[Return Main Menu](#)



Water Supply Forecast (Issued 07-08-2008)

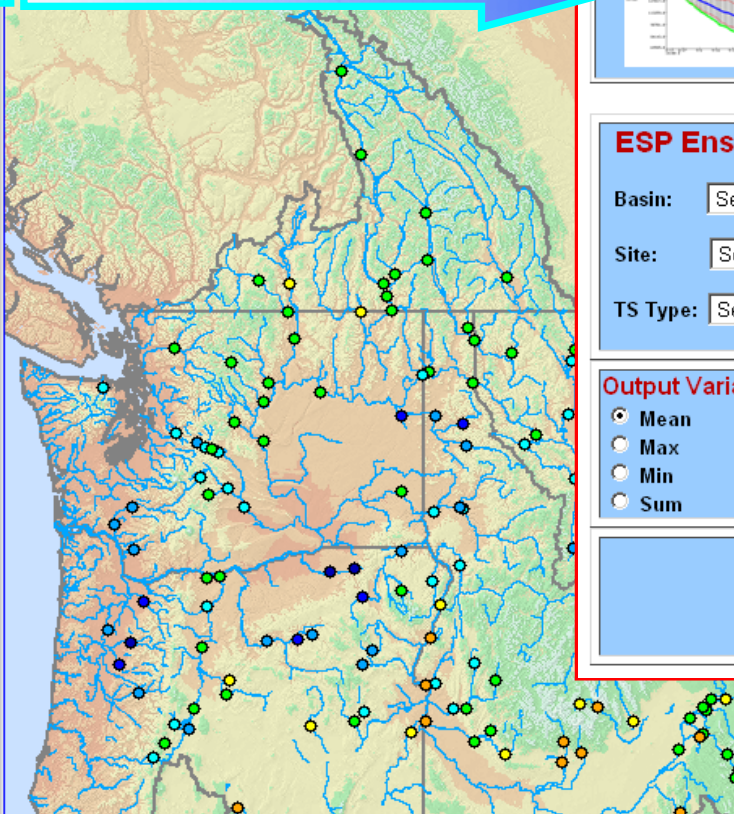
Next Official Water Supply Issued Mid-December 2008


Map data updated 07/08.20:58 GMT, 07/08.13:58 PDT.

Please participate in the 2008 Hydrologic Services

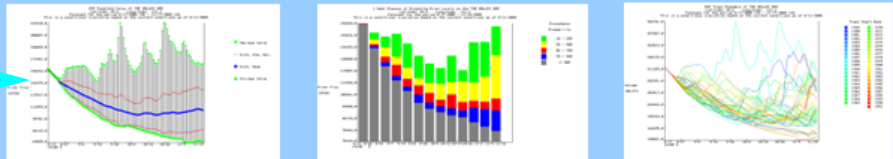
Place cursor over point for Station Info, click point for data plot.
Select Zoom Option to zoom in on map

Click to: Select Zoom: Zoom to: 4x 8x





NOAA-NWRFC ESP Interactive Ensemble Analyzer



ESP Ensemble Trace Files

Basin:

Site:

TS Type:

Output Variable:

☒ Mean
☐ Max
☐ Min
☐ Sum

Accumulation Interval:

☒ Day
☐ Week
☐ Month
☐ Entire Period

Start Date

03 Sep 2008

End Date

03 Dec 2008

Plot Options:

☒ Traces ☐ Probability ☐ Expected Value ☐ Exceedance



ESP Interactive Ensemble Analyzer

Ensemble Members (Traces)



NOAA-NWRFC ESP Analysis Plot

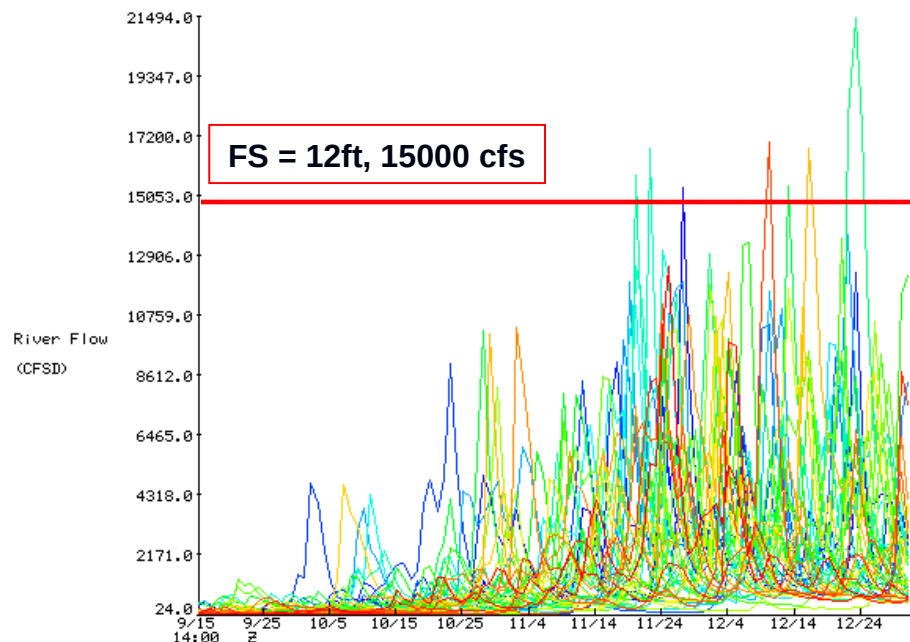
(TLMO3) WILSON-NEAR TILLAMOOK

County: TILLAMOOK State: OR

Elevation: 42 (feet) Latitude: 45 28' 33" Longitude: 123 43' 30"

[Click to download TRACES](#)

ESP Trace Ensemble of WILSON RIVER at WILSON R N TILLAMOOK
Latitude: 45.5 Longitude: 123.7
Forecast for the period 9/15/2008 14h - 12/31/2008 14h
This is a conditional simulation based on the current conditions as of 9/2/2008



Trace Start Date

<input type="checkbox"/> 1949	<input type="checkbox"/> 1970
<input type="checkbox"/> 1950	<input type="checkbox"/> 1971
<input type="checkbox"/> 1951	<input type="checkbox"/> 1972
<input type="checkbox"/> 1952	<input type="checkbox"/> 1973
<input type="checkbox"/> 1953	<input type="checkbox"/> 1974
<input type="checkbox"/> 1954	<input type="checkbox"/> 1975
<input type="checkbox"/> 1955	<input type="checkbox"/> 1976
<input type="checkbox"/> 1956	<input type="checkbox"/> 1977
<input type="checkbox"/> 1957	<input type="checkbox"/> 1978
<input type="checkbox"/> 1958	<input type="checkbox"/> 1979

ESP Ensemble Trace Files

Basin: WILSON

Site: NEAR TILLAMOOK

TS Type: NAT

Output Variable:

- ☐ Mean
☒ Max
☐ Min
☐ Sum

Accumulation Interval:

- ☒ Day
☐ Week
☐ Month
☐ Entire Period

Start Date

15 Sep 2008

End Date

31 Dec 2008

Plot Options:

- ☒ Traces ☐ Probability ☐ Expected Value ☐ Exceedance

Show Plot Show Table

Ensemble Plot

This plot is often referred to as the 'spaghetti' plot. It displays all of the traces together on the same plot. This plot does not contain explicit probabilistic information but does show the variability of the forecast data. The Y-axis is the selected hydrologic parameter and the X-axis is date of the analysis selected at forecast time. The trace color code represents the year. Traces will show the streamflow time series for each calibration year over the selected analysis period. Data will be aggregated for the interval selected. For example, if you select Mean and Day, you will get the mean daily flows each day of the analysis period.



ESP Interactive Ensemble Analyzer

Exceedance Probability Plot



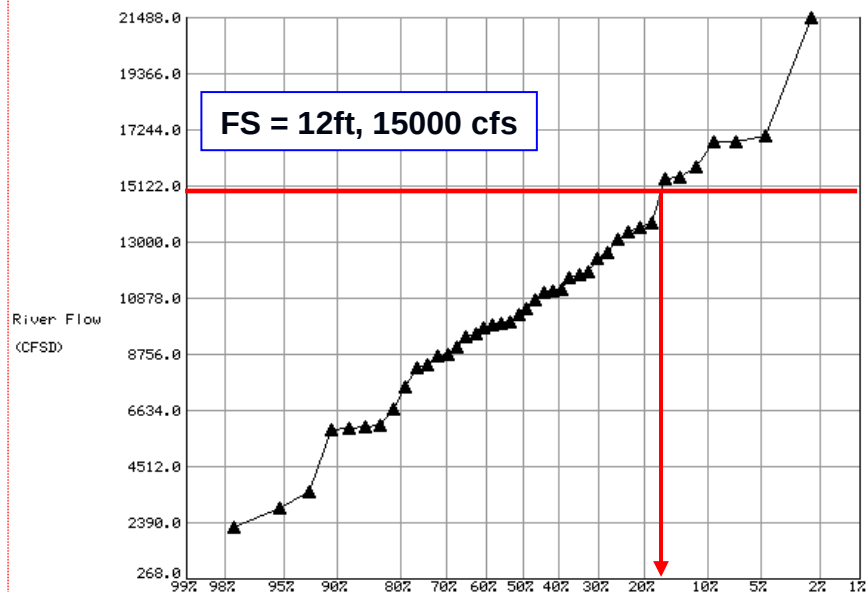
NOAA-NWRFC ESP Analysis Plot

(TLMO3) WILSON-NEAR TILLAMOOK

County: TILLAMOOK State: OR
Elevation: 42 (feet) Latitude: 45 28' 33" Longitude: 123 43' 30"

[Click to download TRACES](#)

Chances of Exceeding River Levels on the WILSON RIVER at WILSON R N TILLAMOOK
Latitude: 45.5 Longitude: 123.7
Forecast for the period 9/15/2008 - 1/1/2009
This is a conditional simulation based on the current conditions as of 9/2/2008



Less than 20% chance of flooding between 9/15/08 and 1/1/09

ESP Ensemble Trace Files

Basin: WILSON

Site: NEAR TILLAMOOK

TS Type: NAT

Output Variable:

- ☐ Mean
☒ Max
☐ Min
☐ Sum

Accumulation Interval:

- ☐ Day
☐ Week
☐ Month
☒ Entire Period

Start Date

15 Sep 2008

End Date

31 Dec 2008

Plot Options:

- ☐ Traces ☐ Probability ☐ Expected Value ☒ Exceedance

Show Plot Show Table

Exceedance Plot

The exceedance probability plot presents the results of a frequency analysis of a given output variable for a specified time window. Values of the output variable and/or the fitted probability distribution are plotted against the exceedance probability. Values of the output variable and/or the fitted probability distribution are plotted against the exceedance probability. The exceedance probability is based on the empirical distribution. The degree to which the fitted distribution fits the data values affects the degree of confidence one should place on the probability estimates. When generating probability plots or tables, it's always a good idea to check the exceedance plot to make sure that the assumed distribution is a reasonable fit.



ESP Interactive Ensemble Analyzer

Text Summary and Trace Data



NOAA-NWRFC ESP Analy

(TLMO3) WILSON-NEAR TILLAMOOK

County: TILLAMOOK State: OR
Elevation: 42 (feet) Latitude: 45 28' 33" Longitude: 123 43' 30"

[Click to down load TRACES](#)

ESP Forecast Information

#

Analysis Period: 9/15/2008 06 - 12/31/2008 24 (PST)

Forecast Parameters: River Flow (Max) - (CFSD)

#

Forecast Interval: Forecast Window

Forecast Point: WILSON RIVER at WILSON R N TILLAMOOK

#

	0.90	0.75	0.50	0.25	0.10 Units
--	------	------	------	------	------------

#

09/15/2008 - 12/31/2008	5871.68	8297.55	10335.70	13168.39	16493.31 (CFSD)
-------------------------	---------	---------	----------	----------	-----------------

ESP Ensemble Trace Files

Basin: WILSON

Site: NEAR TILLAMOOK

TS Type: NAT

Output Variable:

- ☐ Mean
☒ Max
☐ Min
☐ Sum

Accumulation Interval:

- ☐ Day
☐ Week
☐ Month
☒ Entire Period

Start Date

15 Sep 2008

End Date

31 Dec 2008

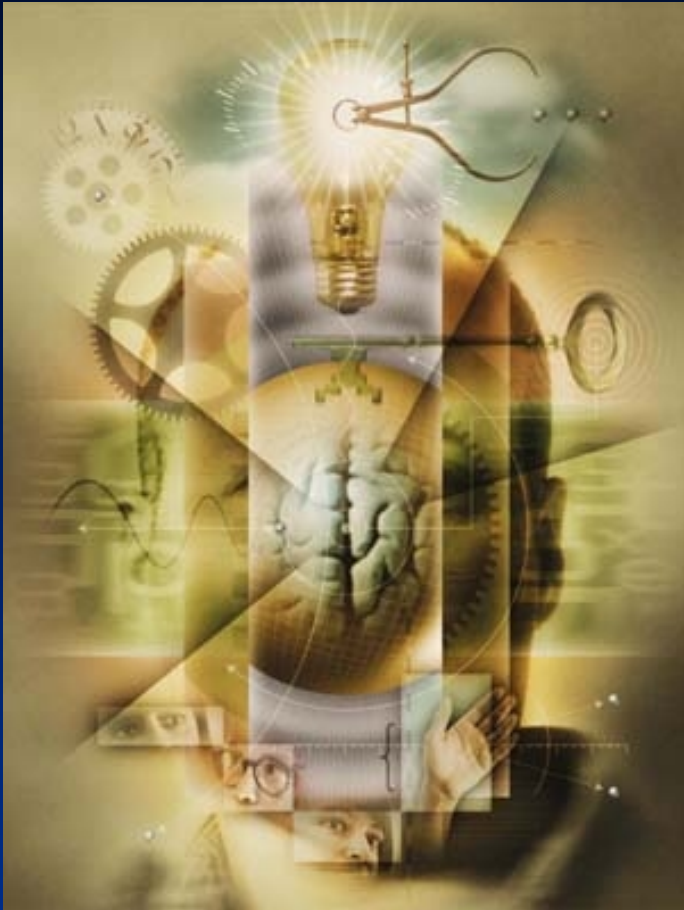
Plot Options:

- ☐ Traces ☐ Probability ☐ Expected Value ☒ Exceedance

Show Plot

Show Table

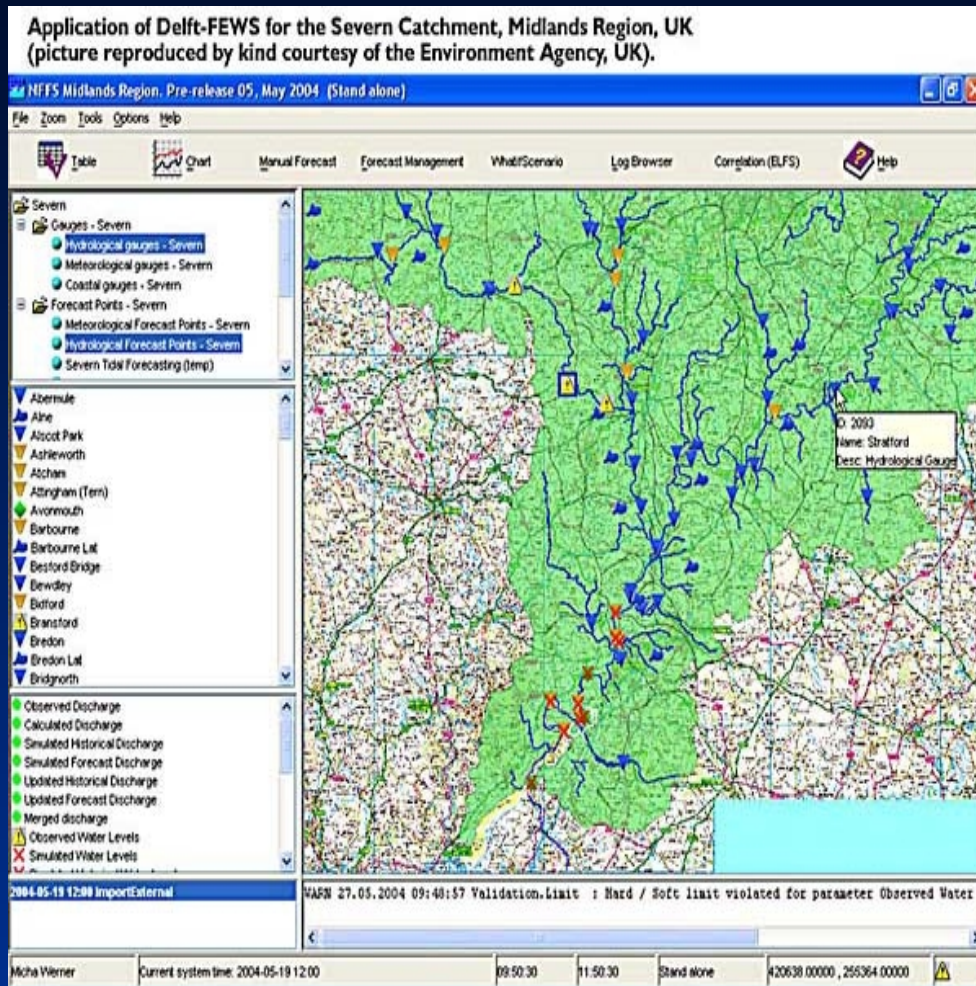
Future NWRFC Changes



- Community Hydrologic Prediction System (CHPS)
- Short-term Ensemble Streamflow Forecast (XEFS)
- Gridded Data Sets
- Expanded Web Services



Community Hydrologic Prediction System (CHPS)



- Customized application of FEWS
- Flexible open-ended software infrastructure
- Rapid integration of new techniques
- Increased ability to collaborate with outside entities



Community Hydrologic Prediction System (CHPS)

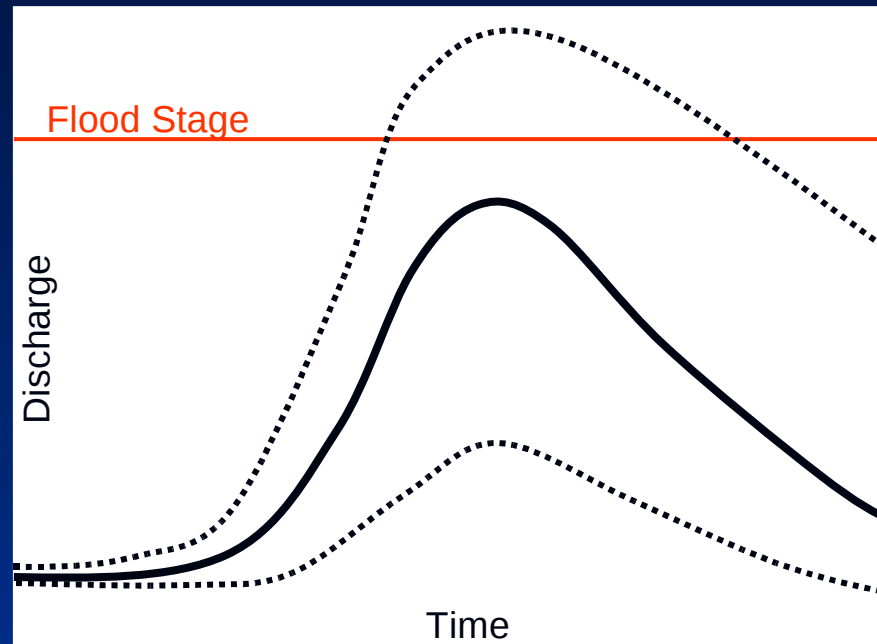


- Implementation planned for 2010
- Additional forecast products and services



Ensemble Streamflow Forecasting

- Stream flow forecast uncertainty



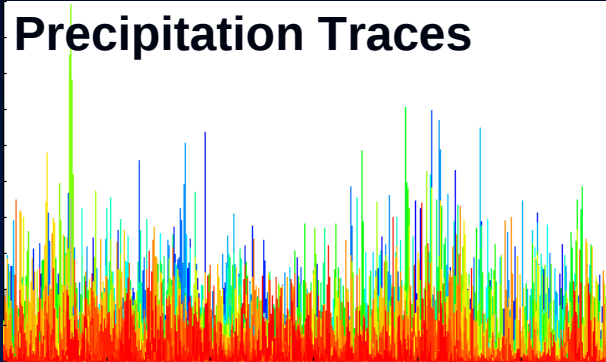


Ensemble Streamflow Forecasting

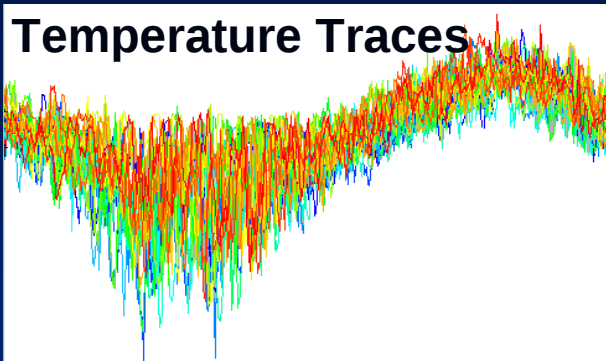
Modeling Uncertainty



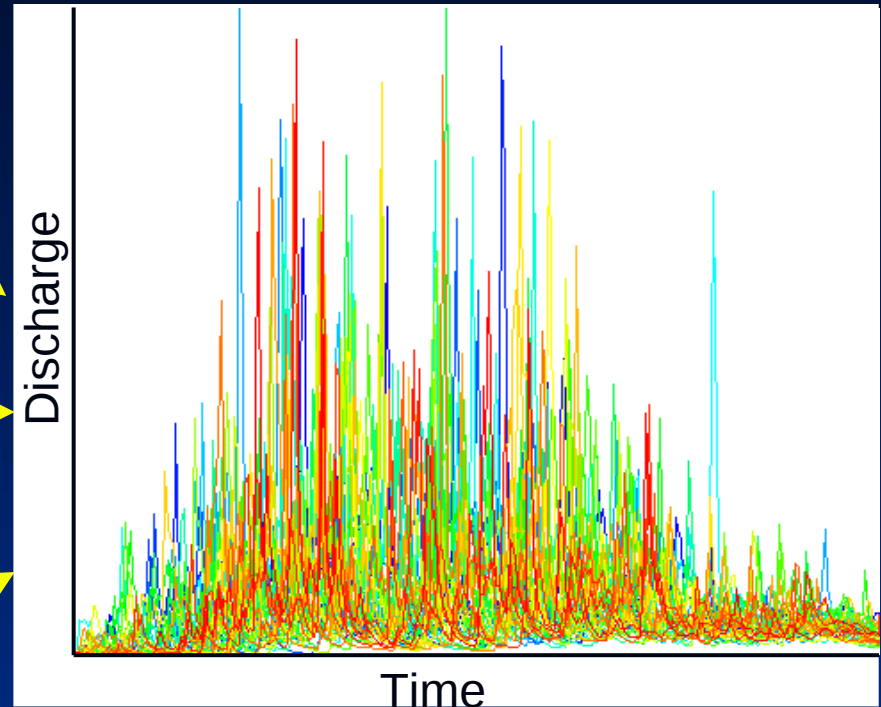
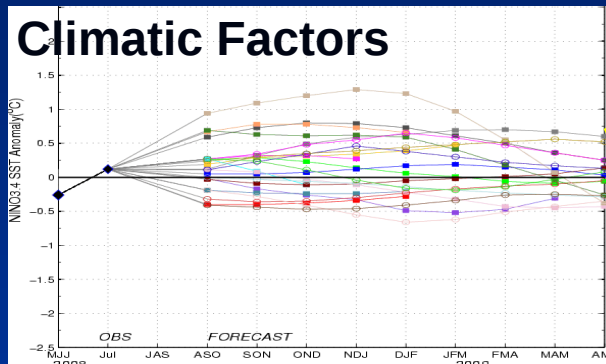
Precipitation Traces



Temperature Traces



Climatic Factors



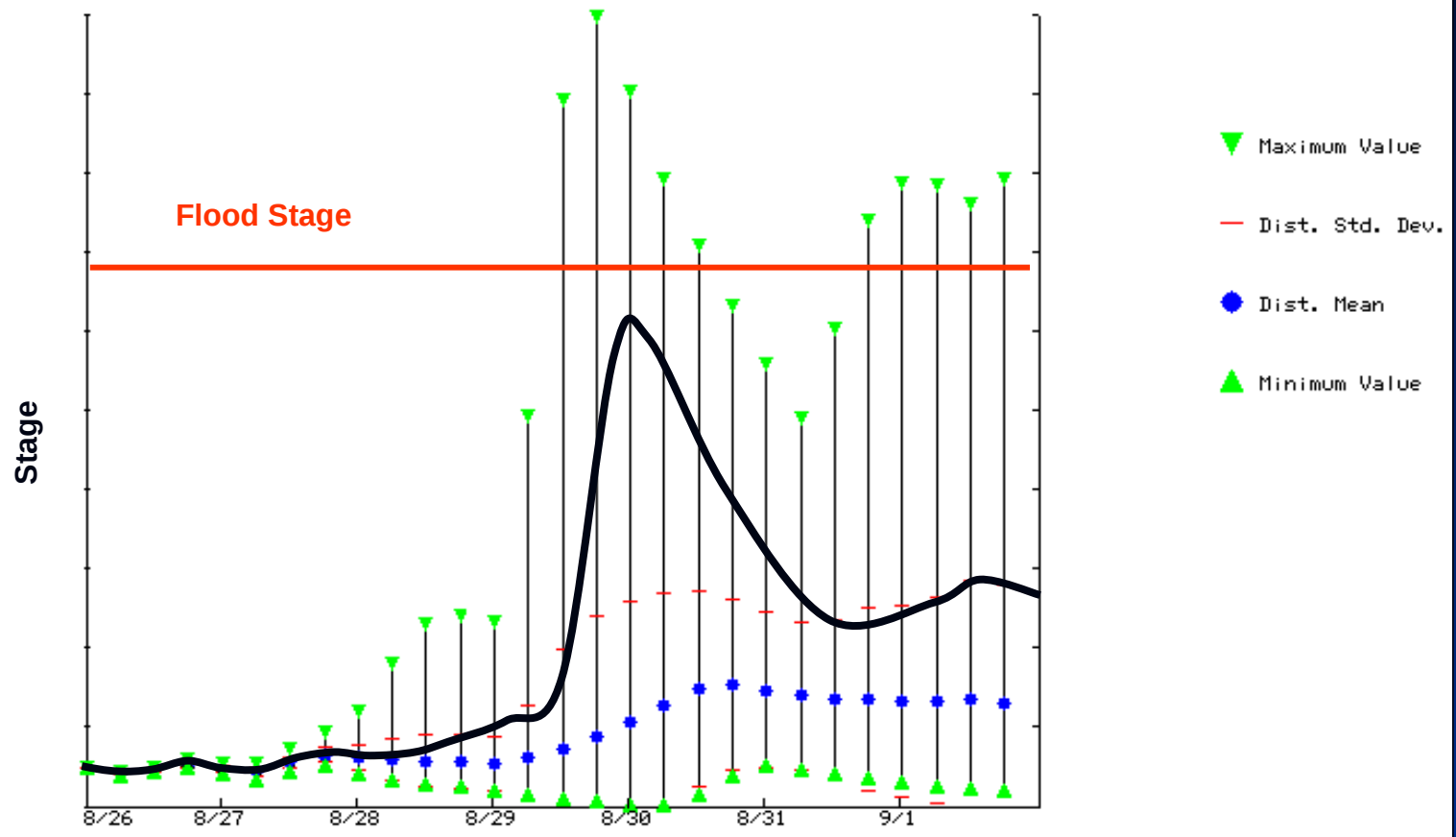


Ensemble Streamflow Forecasting

Example Product



Implementation planned for 2010 with CHPS

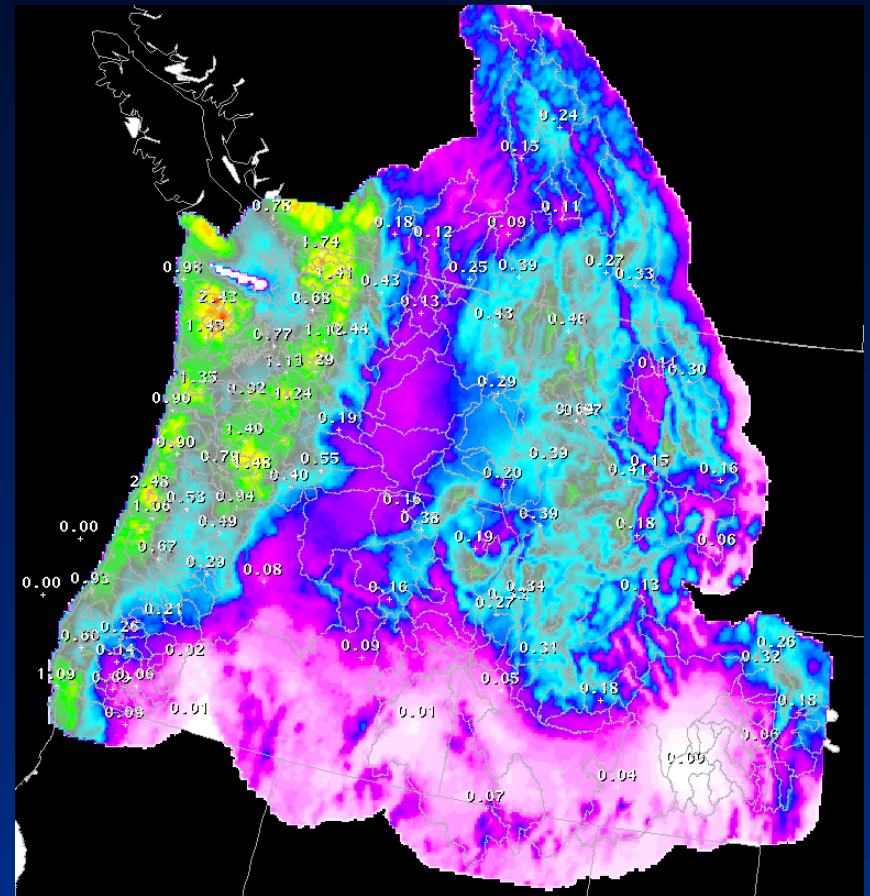




Gridded Datasets



- 2.5 km grid
- RFC generated Precipitation Forecasts
- RFC generated Temperature Forecasts
- Projected for 2010 with CHPS implementation

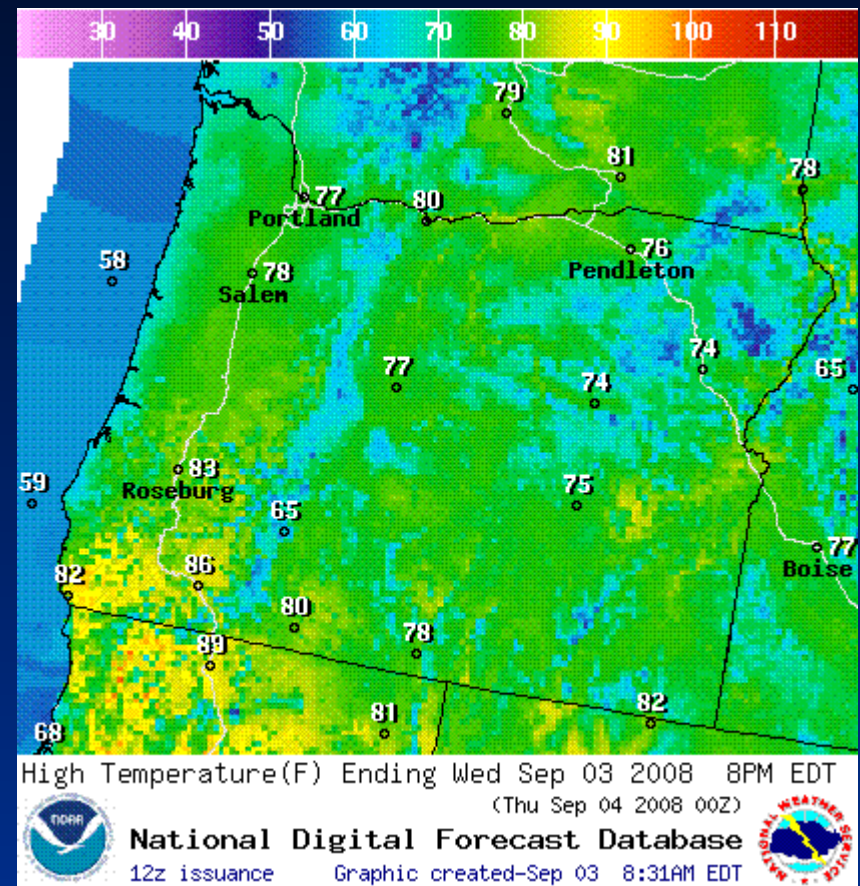




Gridded Datasets



- WFO grids currently available from the National Digital Forecast Database (NDFD) (www.weather.gov/ndfd)
- Formats
 - GRIB2
 - XML
 - Graphical





Expanded Web Services

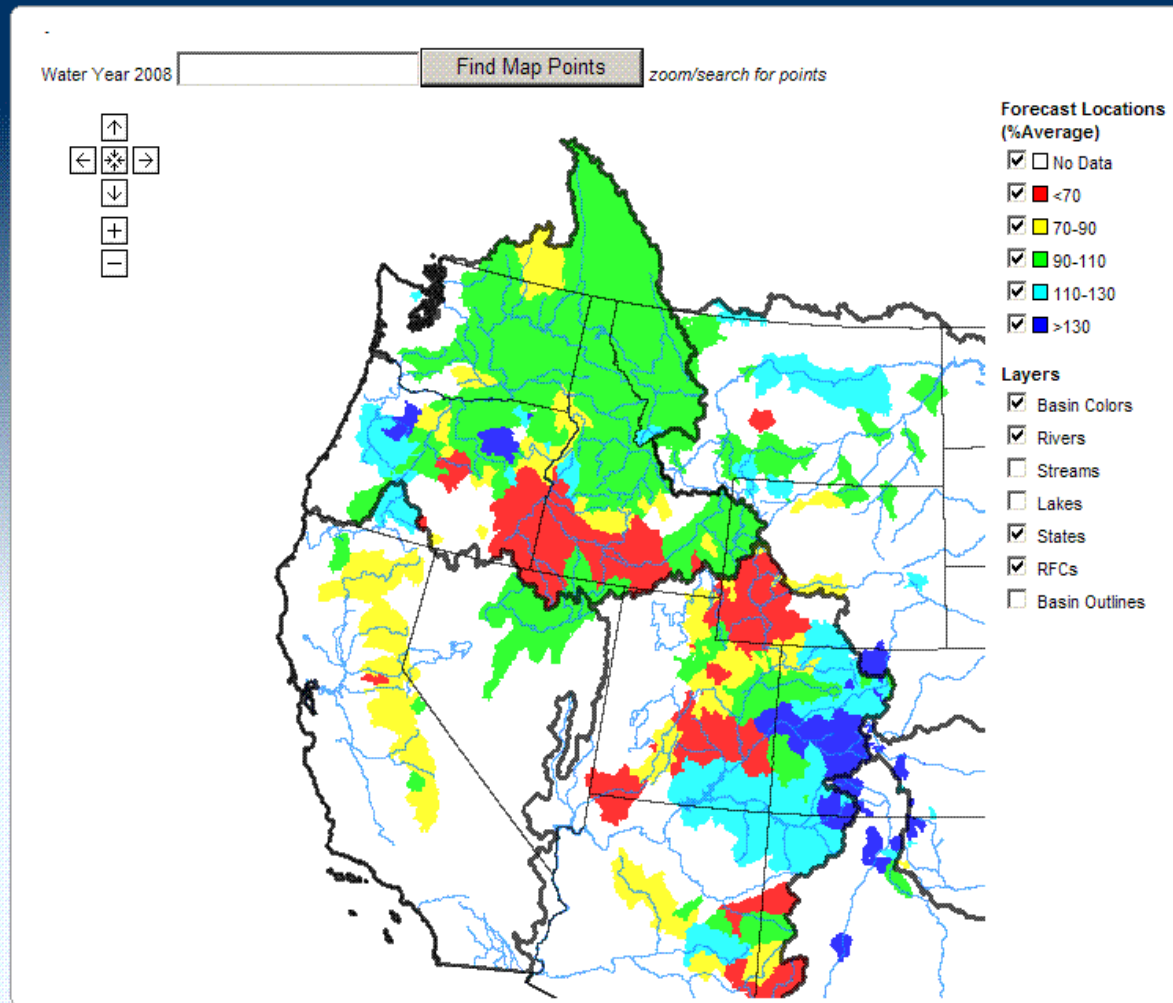


- Western Water Supply
<http://www.nwrfc.noaa.gov/westernwater>



National Weather Service Western Region Western Water Supply Forecast

v1.0



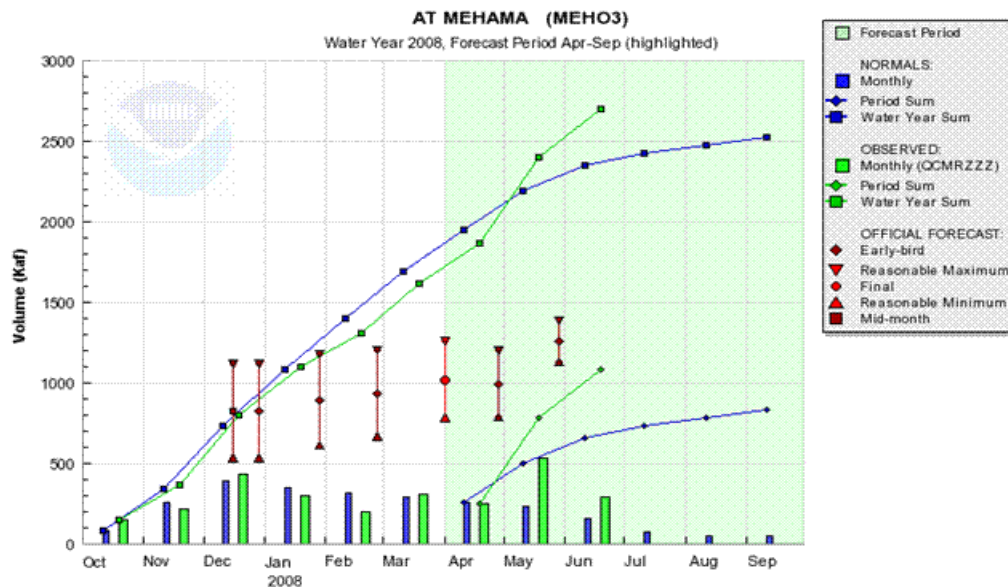
Western Water Supply Application Suite - version 1.0



National Weather Service Western Region Seasonal Runoff Forecast Evolution Plot



v2.0



NWRFC/NWS/NOAA 08/29/08 23:05:01 UTC

Water Supply Forecasts	Ensemble Forecasts	Observations	Graph Options
<input checked="" type="checkbox"/> Official forecast	<input type="checkbox"/> ESP background	<input checked="" type="checkbox"/> Monthly observed	<input checked="" type="checkbox"/> Period median
<input checked="" type="checkbox"/> Forecast background	<input type="checkbox"/> ESP expected	<input checked="" type="checkbox"/> Period sum observed	<input checked="" type="checkbox"/> Period normal
	<input type="checkbox"/> ESP trace lines	<input checked="" type="checkbox"/> Water year sum observed	<input checked="" type="checkbox"/> Period maximum
More Graph Options		<input checked="" type="checkbox"/> Monthly normals	<input checked="" type="checkbox"/> Period minimum
Start Water Year: <input type="text" value="2008"/>		<input checked="" type="checkbox"/> Period sum normals	<input checked="" type="checkbox"/> Forecast period
End Water Year: <input type="text" value="2008"/>		<input checked="" type="checkbox"/> Water year sum normals	<input checked="" type="checkbox"/> Require maximum
Period: <input type="text" value="Apr-Sept"/>			<input checked="" type="checkbox"/> Grid
<input type="button" value="Update"/>			

Western Water Supply Application Suite - version 1.0



National Weather Service/River Forecast Center Western Water Supply Application Suite



NOAA/NWS Water
Resource Forecasts

water supply
map

water supply
forecasts

ensemble
forecast

verification

climate
scenarios

data
checkout

about
western water

Location: Columbia at The Dalles, Oregon (TDAO3 - NWRFC)

change location

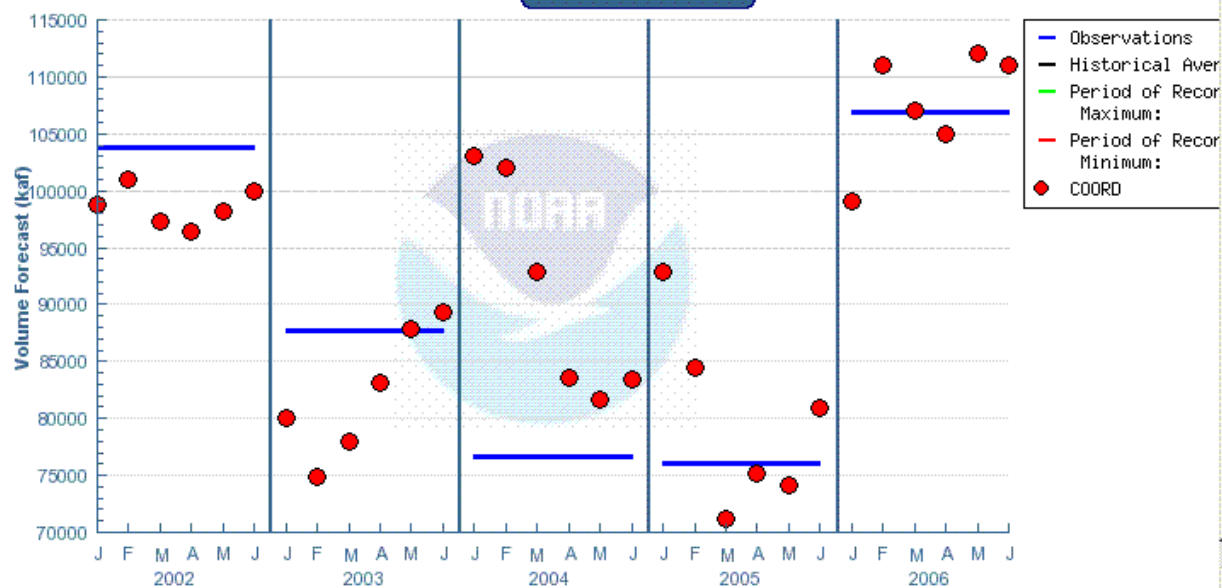
clear location

Seasonal Forecast Verification and Analysis

Historical - THE DALLES (TDAO3)

Forecast Period: Jan - Jul

Climatology Period: -



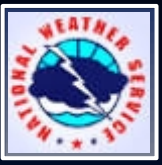
Options

Statistic

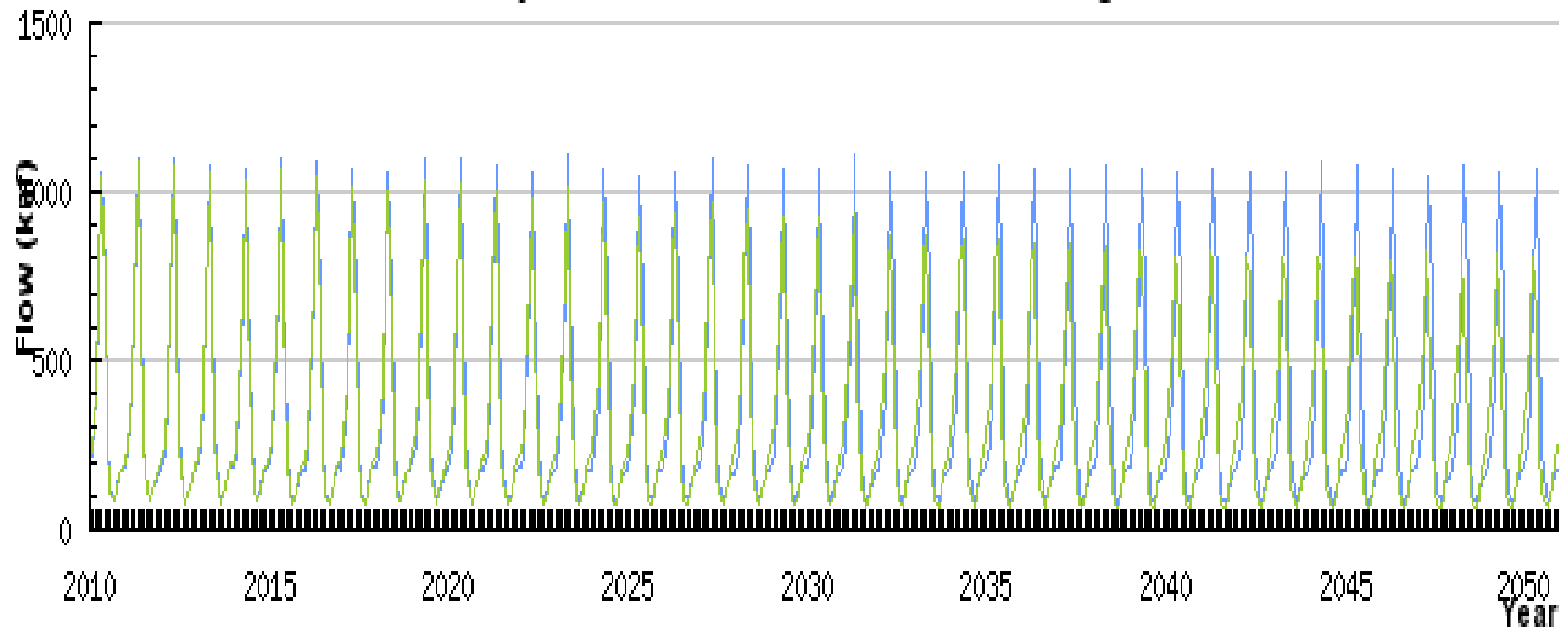
- ☒ Historical
- ☐ Streamflow Histogram
- ☐ Scatterplot
- ☐ MAE (Lead Time)
- ☐ MAE (Years)
- ☐ RMSE (Lead Time)
- ☐ RMSE (Year)
- ☐ Skill Score (Lead Time)
- ☐ Skill Score (Years)
- ☐ POD Above Climatology
- ☐ POD Below Climatology
- ☐ FAR Above Climatology
- ☐ FAR Below Climatology
- ☐ Rank Histogram
- ☐ Rank Histogram (Lead Time)
- ☐ Percent Difference

Forecast Types

Time Scale



Monthly Accumulation Mean for Climate Change at DWR11



Arbitrary changes to basin temperature imposed on forcing time series
(e.g. 0.1 F / year in example above)



www.nwrfc.noaa.gov
www.nwrfc.noaa.gov/presentations

5241 NE 122nd Avenue
Portland, OR 97230